Universidade de Aveiro
2014

Departamento de Biologia

DIANA GOUVEIA RAMOS

Taxonomy, distribution and ecology of the order Phyllodocida (Annelida, Polychaeta) in deep-sea habitats of the Iberian margin

Taxonomia, distribuição e ecologia da ordem Phyllodocida (Annelida, Polychaeta) em habitats profundos da margem Ibérica

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Dissertação apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Biologia Marinha, realizada sob a orientação científica da Professora Doutora Maria Marina Pais Ribeiro da Cunha, Professora Auxiliar do Departamento de Biologia da Universidade de Aveiro e sob a co-orientação da Doutora Ascensão dos Anjos Alves Ravara, Investigadora de Pós-Doutoramento do CESAM do Departamento de Biologia da Universidade de Aveiro.

'Worm! Worm!' Saruman called; and out of a nearby hut came Wormtongue, crawling, almost like a dog. 'To the road again, Worm!' said Saruman. 'These fine fellows and lordlings are turning us adrift again. Come along!' (J.R.R. Tolkien, The Lord of the Rings)

o júri

presidente

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Técnico Superior do Centre d'Estudis Avançats de Blanes – Consejo Superior de Investigaciones Científicas

Doutora Ascensão dos Anjos Alves Ravara (co-orientadora)

Investigadora de Pós-Doutoramento do Departamento de Biologia da Universidade de Aveiro

agradecimentos

This thesis was carried out with the contribution of the following projects/programs:

- Swimglo (PTDC/MAR/100522/2008)
- Ocean Exploration Trust
- ESF MarinERA Redeco project (Marin-ERA/MAR/0003/2008)
- programme Training Through Research (IOCUNESCO)
- CHEMECO ESF EURODEEP project (FCT; EURODEEP/0001/2007)
-ESF EuroDIVERSITY Microsystems project (05_EDIV_FP083- MICROSYSTEMS)
- ESF Euromargins Moundforce project (01-LEC-EMA06F-Moundforce)
- EC FP6 IP HERMES project (EC contract number GOCE-CT-511234)
- EC FP7 IP HERMIONE project (contract ENV/2008/1/226354)

I would firstly like to acknowledge my supervisor, Professor Marina Cunha, for supervising me once again, for all of your sympathy, kindness, patience, and for all the guidance and knowledge transmitted along this work, you are one of the most admirable person I met, until today, in many ways.
I would also like to acknowledge my co-supervisor, Doctor Ascensão Ravara, undoubtedly, the "Queen of the polychaetes" (as I read in your book) for your huge patience, threshold, sympathy, and for all of your advices. I deeply admire you, and a great part of this work, is also yours.
Thanks to all the professional, nice, funny, serviceable, and even sometimes friendly LEME (Laboratório de Ecologia Marinha e Estuarina) fellows, it was a pleasure working with you. Obviously I couldn't forget the friendship and the union with my MSc fellows, "os colegas", you'll be always in my heart, thank you.
Thanks to all my friends who supported me, I adore you.
Finally thank you to my mother and my step-father, for all your love and comprehension, you are my pillars of support.

Chega o momento em que temos tanto para dizer, tantas pessoas para agradecer, mas o espaço/tempo não o permite… De qualquer modo, a todos aqueles que não mencionei (eles sabem quem são, o meu profundo agradecimento, sem vocês não teria chegado até aqui).

Gostaria de agradecer primeiramente à minha orientadora, a Professora Doutora Marina Cunha, por mais uma vez ter aceite ser minha orientadora na realização deste trabalho, por toda a sua simpatia, tolerância, paciência, amabilidade, alegria e conhecimentos, que me transmitiu durante todos os momentos que precisei, e pela sua ajuda imprescindível neste trabalho, é sem dúvida, uma das pessoas que mais admiro, em todos os sentidos.

Gostaria de agradecer (também novamente), à minha co-orientadora, a Doutora Ascensão Ravara, indubitavelmente a "Rainha dos poliquetas" (como li, num livro seu), pela sua enorme paciência comigo, pela sua simpatia, prestabilidade, pela transmissão dos seus inúmeros conhecimentos, pelos seus conselhos em todos os aspetos (não apenas profissionais). Admiro-a profundamente, e é sem dúvida uma grande profissional, grande parte deste trabalho é seu também, muito obrigada.

É motivante quando se trabalha mutuamente com pessoas profissionais, alegres, divertidas, simpáticas, sempre prestes a ajudar-nos, e que para além de serem colegas, revelam-se mesmo muitas vezes amigas de verdade, apoiando-nos sempre que precisamos. Assim, deixo aqui o meu enorme agradecimento a todas as pessoas com as quais convivi no LEME (Laboratório de Ecologia Marinha e Estuarina), incluindo obviamente os "colegas", com os quais vivenciei momentos inesquecíveis, que me irão ficar para sempre guardados no coração.

Agradeço ainda a todos os meus amigos, que sempre estiveram presentes, quando mais precisei, sem dúvida que quem tem amigos pode não ter tudo, mas quase…

Obrigada à minha mãe e ao meu padrasto por estarem sempre ao meu lado, em todos os momentos, pela vossa enorme paciência, tolerância e carinho, vocês são o meu pilar.

palavras-chave

Poliquetas, ordem Phyllodocida, taxonomia, ecossistemas de mar profundo, biogeografia

resumo

Os poliquetas são anelídeos maioritariamente marinhos, com ampla distribuição global, que constituem uma fonte de alimento para as comunidades bentónicas e demersais representando assim uma relevante função ecológica. A maioria das espécies é típica de ambientes marinhos distribuindo-se de um modo geral desde a zona intertidal até profundidades abissais, e ocupando uma grande variedade de habitats, como sedimentos lodosos e/ou arenosos das zonas estuarinas, costeiras e profundas, recifes de coral, entre outros (Glasby *et al*., 2000). Vivem frequentemente associados a ecossistemas quimiossintéticos marinhos, tais como fontes hidrotermais, vulcões de lama ou fontes frias, os quais albergam uma enorme diversidade de seres vivos.

O presente trabalho consiste numa revisão taxonómica dos poliquetas pertencentes à ordem Phyllodocida, colhidos em diversas campanhas oceanográficas decorrentes desde 2002 a 2012, em diversas áreas da margem Ibérica desde o Golfo da Biscaia ao Golfo de Cádis (Oceano Atlântico) e Mar de Alborão (Mediterrâneo Ocidental), em diferentes habitats batiais, mas principalmente em vulcões de lama, e recifes de coral de profundidade. Adicionalmente, foram analisadas algumas amostras colhidas em montes submarinos do Atlântico e na região Oriental do Mar Mediterrâneo. O estudo pretende contribuir para o conhecimento da biodiversidade em ecossistemas marinhos profundos, a partir do estudo morfológico e taxonómico de espécies da Ordem Phyllodocida (Polychaeta). São referidos aspetos de habitat e distribuição através do uso de bibliografia disponível, e ainda a partir de um estudo ecológico da ordem. Em alguns casos não foi possível a determinação ao nível de espécie apresentando-se apenas considerações taxonómicas que servirão de base a um estudo futuro mais detalhado, preferencialmente com base em análises moleculares, de forma a obter uma identificação mais precisa dos mesmos

keywords Polychaetes, Phyllodocida order, taxonomy, deep-sea ecosystems, biogeography

abstract

The polychaetes are mostly marine annelids, with a worldwide distribution, which constitute a food source of benthic and demersal communities, representing this way a relevant importance in an ecological approach. Most species are typical from marine ecosystems, and they are usually distributed from the intertidal zone to abyssal depths occupying a huge variety of habitats, from estuarine and sandy muds to coral reefs and deep-sea muds (Glasby *et al*., 2000). They live frequently associated with marine chemosynthetic ecosystems, such as hydrothermal vents, mud volcanoes, or cold seeps, that host a high biodiversity of fauna.

The present work represents a taxonomic review of the polychaetes belonging to the order Phyllodocida, sampled in many oceanographic cruises from 2002 to 2012, in the Bay of Biscay, Gorringe Bank, Atlantis seamount, Alboran Sea and eastern Mediterranean, in several ecosystems such as mud volcanoes, cold seeps, submarine mounds and deep sea corals. This work includes a detailed knowledge of the biodiversity in deep sea ecosystems, made by a morphological study using identification keys, diagnosis and descriptions of the families, genera and species of the order Phyllodocida using the available bibliography, and also an ecological study of the order. In some cases, a determination to a species level was not possible but taxonomic remarks are given which will be a basis for further study of those specimens, preferably including the use of molecular tools, in order to achieve more clear results.

INDEX

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1. The oceans and the deep-sea

Planet Earth is covered by 1.36 billion km^3 of water, which covers more than 70 percent of its surface, representing this way a tri-dimensional space full of unknowns (Schneider & Batson, 2008; Snelgrove, 2010) (Figure 1). The five oceans of the planet host the greatest structures of the Earth, like the largest submarine mountain, the Mid-Atlantic Ridge (four times longer than the Andes, Rockies, and Himalayas combined), the biggest structure built by living organisms, the Great Barrier reef, the biggest trench (Mariana's Trench) and diverse habitats (some in extreme conditions) that host a large number of species, many of them still unknown to scientific community. Only in the last years 250,000 new species have been described for the deep sea, within the scope of the Census of Marine Life program and that number is still increasing (Snelgrove, 2010).

Figure 1. Planet Earth, satellite picture by NASA.

The oceans play an essential role on earth making the planet livable (Snelgrove, 2010). They provide habitats for millions of species and many resources for human populations such as food, bioactive molecules, gas, oil… They also provide many important services for the right functioning of the planet, like climate regulation, and nutrient regeneration (Danovaro *et al.,* 2008) (Figure 2). Our subsistence is highly dependent of the sea, as in the 60 last years have been extracted above 3.500 billions of tons of fish and half of the domestic oil has marine origin (Snelgrove, 2010). It is estimated that 70% of atmosphere oxygen has origin on marine photosynthesis that is responsible for the production of billions of tons of oxygen (Snelgrove, 2010). Most of the oil and gas existing in our houses have marine origin and become from deep-sea habitats.

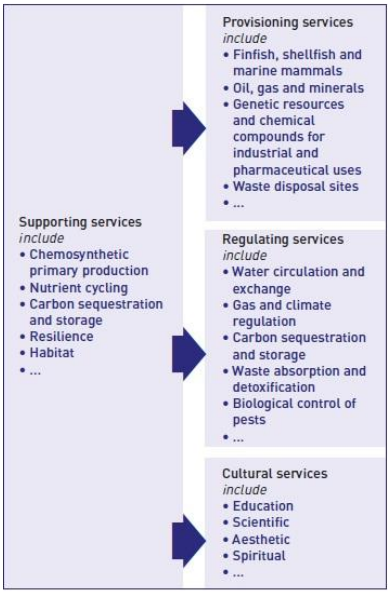

Figure 2. Examples of deep-sea goods and services (UNEP, 2007).

As said previously, the oceans are a tri-dimensional space, though not uniform. They are subdivided in many regions with different characteristics. The marine ecosystem is subdivided in two distinct, but interdependent compartments: the pelagic one, which comprises the water column and the benthic one that comprises the sediment substracts. In terms of bathymetry, the ocean is subdivided in many layers. The first one, until 200 m depth, has penetration of light and this area is known as the photic zone or the epipelagic zone. It is in this area where marine photosynthesis occurs and where many organisms live because their life depends on sun radiation. Below the epipelagic zone, begins the mesopelagic or the "twilight" zone (200 to about 1,000 meters of depth), where there is little or no sunlight and less temporal variation of the temperature. Here is where the thermocline is located, and in the warmer regions of the world the temperatures vary from over 20º C at the top of the layer, to around 4º C at the bottom (Figure 3). Below mesopelagic zone is the bathypelagic zone or "midnight zone", from approximately 1,000 meters down to about 4,000 meters, where the average temperature is about 4°C. Its name is related to the complete lack of light. Consecutively, is the abyssal pelagic zone that extends from 4,000 to 6,000 meters. This area is characterized by the lack of nutrients and constant temperatures rounding 2º C to 3°C. Between around 6,000 meters to the bottom of the ocean is the hadalpelagic zone or hadal zone, which delineates the deepest trenches (like the deepest world trench-Mariana's Trench). The hadal zone is characterized by low density and low diversity of marine life. Finally, there is the benthopelagic zone, which includes waters directly above the bottom in areas of at least 200 meters depth and the seafloor itself (UNEP, 2007).

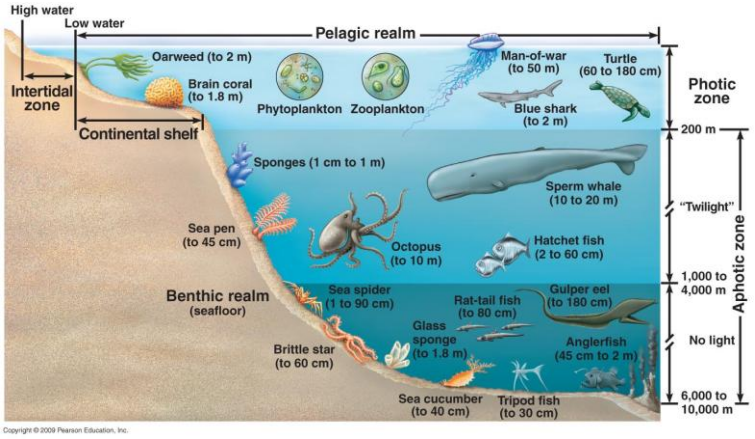

Figure 3. Ocean divisions (source: http://www.anselm.edu/homepage/jpitocch/genbi101/ ecology3 biospehre.html).

The deep-sea is commonly considered to be the water column and the bottom of the sea that lies below 200 m depth, where light is absent, and corresponds to 64% of planet surface and 90% of the ocean's area. It is the most extensive and unknown biome on Earth (Danovaro *et al.*, 2010). Previously seen as a monotonous environment, it is now known that deep-sea ecosystems host the largest portion of the yet-to-be discovered biodiversity and holds some of the most remarkable marine life we know (Danovaro *et al.,* 2010; Roberts *et al.*, 2005).

Before 19th century research expeditions, deep sea was regarded as a vast, constant and avoid of life environment, and deep sea organisms were believed to feed on food sinking from the epipelagic zone (UNEP, 2007). This concept of "zero life" in the deepest ocean was formulated by Edward Forbes, while dredging in the Aegean Sea in the mid-19th century. Forbes noticed that plants and animals lack with increasing depths and proposed his azoic hypothesis that suggested that life would be extinguished altogether in the murky depths of the deep ocean, at depth of approximately 550 meters (Anderson and Rice, 2006). Deep sea was seen as a dark, cold, with high pressure, inactive and anoxic environment.

Since then a great number of research expeditions have proven the opposite. It was with H.M.S. 'Challenger' expedition, from 1872 until 1876 that azoic hypothesis fell apart, and it was realized the existence of life at great depths, at least 5,500 m. Afterward expeditions, such as the circumglobal Danish Galathea expedition of 1950-1952, confirmed this idea by recovering animals from depths greater than 10,000 m. Later, in the 1970's and 1980's, deep-sea habitats such as hydrothermal vents and cold seeps were discovered (Baldrighi, 2012). Deep-sea investigation has evolved in the last years, although very slowly. Only about 0.0001% of the deep sea has been investigated, which may be

correlated to the complexity of this environment, to its inaccessibility and the scarcity of well developed technological and methodological equipment (UNEP, 2007).

With an average depth of 3,730 m, deep sea is not a uniform environment and can be highly dynamic. In geological terms it is sculpted by many features such as canyons, submarine mountains and trenches (UNEP, 2007). Deep-sea temperature usually ranges from 4 to -1°C, with exceptions of the Red Sea and Mediterranean Sea where bottom temperatures are higher (Gage & Tyler, 1991). Deep-sea waters are usually considered to be oxic, although in bathyal depths values of dissolved oxygen decrease, and its salinity values are relatively constant. The deep sea floor is usually covered by muddy sediments, which can be related to the local currents that have very low velocities. However, in some areas along the continental margins, local currents have high velocities and can create benthic storms (Baldrighi, 2012). There is no light in deep sea so its inhabitant organisms are heterotrophic and feed on organic matter coming from surface waters, or feed on organic matter oxidized from mineral substances coming from chemotrophic ecosystems (such as hydrothermal vents and cold seeps).

In terms of organisms, deep sea is characterized by low biomass and low growth, reproduction and recolonization rates (Smith *et al.,* 2006). However, it has a great diversity of organisms of all sizes and types living in extreme conditions (Figure 4). It is believed to have the highest diversity on Earth. The most common fauna of abyssal seafloor habitats are polychaete worms, copepods, isopods, and nematodes (Smith *et al.,* 2006).

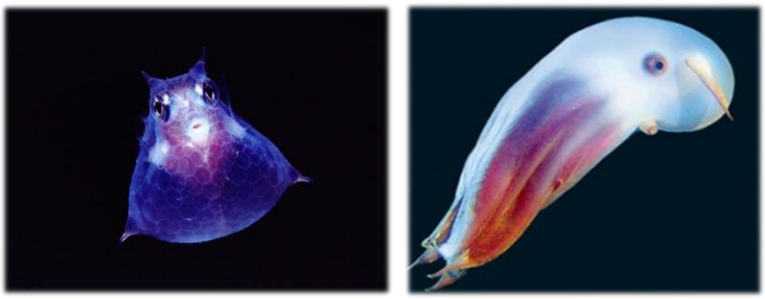

Figure 4. Some deep sea animals. Left - Juvenile Roundbelly Cowfish (*Lactoria diaphana*) (Chris Newbert, source: neatorama.com); Right: Dumbo Octopus (*Grimpoteuthis*) (source: http://www.squidoo.com/top-5-wild-and-wacky-animals).

Usually there is a pattern of highest biodiversity from around 1,000 to 2,000 m depth, and then decreases towards the abyss. It is also observed a higher biodiversity along the continental margins. Continental slopes, ridges and seamounts are expected to host most of the undiscovered biodiversity of the globe (UNEP, 2007).

1.2. Deep-sea habitats

Deep-sea lodge many habitats including seamounts, abyssal plains, hydrothermal vents, cold seeps, mud volcanoes, whale falls, cold-water coral reefs, canyons and the ocean trenches. Some of them such as hydrothermal vents, cold seeps and mud volcanoes are chemosynthetic habitats that host unique endemic fauna (Figure 5).

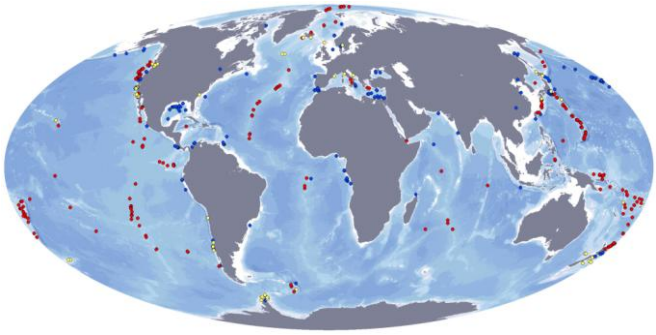

Figure 5. Global distribution of worldwide chemosynthetic ecosystems whose fauna has been studied: red - hydrothermal vent; blue- cold seep; yellow- whale fall (authors: M. Baker and D. Cuvelier, source: http://www.ploscollections.org/article/info%3Adoi%2F10.1371%2Fjournal.pone. 0023259).

Chemosynthesis is a process in which carbon molecules and nutrients are converted by microbes into organic matter, by the oxidation of inorganic molecules such as hydrogen gas and hydrogen sulfide, or methane as a source of energy, in other words, energy is produced by chemical reactions rather than sunlight, as occurs in photosynthesis. Chemosynthetic ecosystems show the highest biomasses and productivity of all ecosystems found in the deep sea, although their biota is still higly unidentified and more than 99% of the organims remain to be discovered. Those organisms have intriguing life styles, reproduction strategies and symbiotic relations (source: http://www.eu-hermione.net/science/chemosynthetic-ecosystems).

Submarine canyons are a steep-sided valley that cut into the sea floor of the continental slope, sometimes extending until the continental shelf and are characterized by high hydro-dynamism (Bianchelli *et al.*, 2013). They connect continental shelves to deep ocean basins and concentrate detrital organic-matter that can sustain huge biomasses of infaunal megabenthic invertebrates over large areas (De Leo *et al.*, 2010).

Abyssal plains are underwater plains on the deep ocean floor commonly occurring in water depths of about 3,000 to 6,000 meters. They are generally flat and constitute approximately 40 % of the ocean floor and 51 % of the Earth. They can be geologically active being associated with tectonic plates. Thus, they comprise oceanic trenches that are depressions of the sea floor as a result of convergence of

tectonic plates, or oceanic ridges that are underwater mountains formed by divergence of tectonic plates, resulting in seafloor spreading. Abyssal plains ecosystems are characterized by low biomass, large habitat extension, high biodiversity and complex topographic and hydrodynamic features (UNEP, 2007).

Seamounts are underwater mountains resultant from volcanic activity associated with the divergence of tectonic plates. They often have a complex topography of terraces, ridges, pinnacles crevices and craters, and they interact with the water currents surrounding them creating a variety of living conditions and substrates that provides suitable habitat for rich and diverse communities (UNEP, 2007).

Hydrothermal vents are chemosynthetic ecosystems that consist on fissures in the sea bottom, commonly found in volcanically active areas where geothermally heated gases and water plumes rich in minerals and chemical energy are expelled from the seafloor (Figure 6). They were first discovered in 1977 and have a worldwide distribution at depths greater than 850 m. The minerals from the superheated plumes, of temperatures above 400°C, precipitate in contact with the cold surrounding deep waters forming polymetallic sulphide deposits. This polymetallic sulphide deposits include many metals such as copper, iron, zinc and silver, with significant economic value. Additionally, the "extremophile" fauna around these vents might become a source of organic compounds for industrial and medical applications (ISA, 2004). The hydrothermal vents host a unique fauna of microbes, invertebrates (for example, mussels and crabs) and fish, of which biomass can be 500-1000 times larger than that of the surrounding deep sea. The communities living there depend on the conversion of the sulphur-rich emissions into energy by bacteria, by the chemosynthesis process. These ecosystems have extreme physical and chemical conditions and may provide clues on the evolution of life on Earth apart from being some of the most productive marine ecosystems.

Cold seeps are areas on the ocean floor where water, minerals, hydrogen sulphide, methane, other hydrocarbon-rich fluids, gases and muds are expelled through sediments and cracks in areas containing gases. They are also chemosynthetic ecosystems, but they differ from the hydrothermal vents because their emissions are not geothermally heated and therefore they are cooler, often close to surrounding seawater temperature. However they are also chemosynthetic ecosystems. The variety of features they form on the seafloor, such as mud volcanoes, pockmarks, gas chimneys, brine pools and hydrocarbon cold seeps, sustain exceptionally rich ecosystems which can be an important target for bioprospecting (Arico & Salpin, 2005). They are characterized by high biomass and a unique and usually endemic

species composition. Cold seep communities include large invertebrates that live in symbiosis with chemotrophic bacteria that use methane and/or hydrogen sulphide as energy.

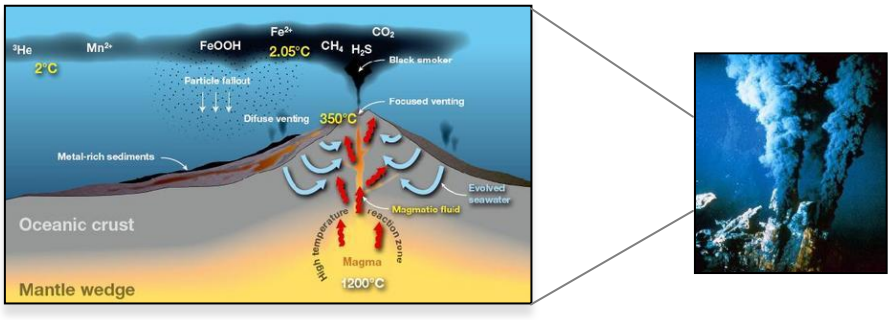

Figure 6. Schematic representation (left) and photo (right) of a hydrothermal vent system (Sources: Left- http://chemtrailsplanet.net/category/global-warming-2/; Right - http://www.buddydivers.nl/schoorstenen_5km_onderwater.html).

Cold seeps are often associated with gas hydrates that are ice solids surrounding a gas molecule, mainly methane (Figure 7). The methane is trapped in gas hydrates and represents a huge energy reservoir. It is estimated that gas hydrates contain 500 - 3,000 gigatonnes of methane carbon (WBGU, 2007), over half of the organic carbon on Earth and twice as much as all fossil fuels (coal, oil and natural gas) combined (Kenvolden, 1998).

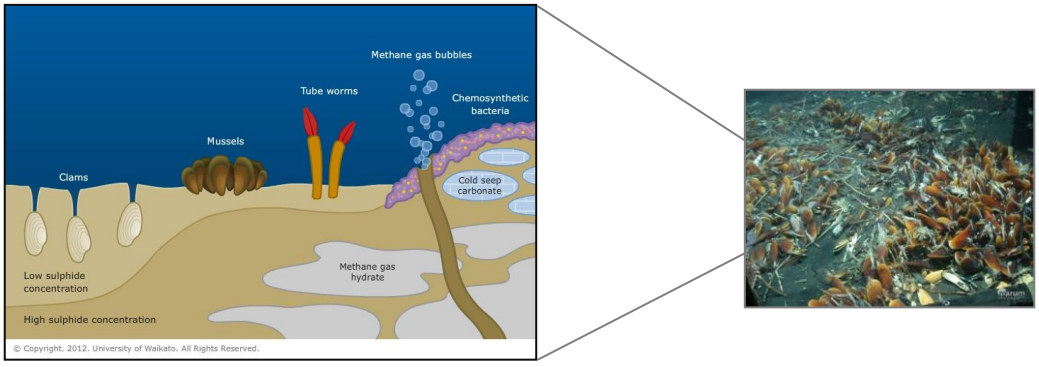

Figure 7. Schematic representation (left) and photo (right) of cold seeps (Sources: Left- University of Walkato (Webiste: http://www.sciencelearn.org.nz/Contexts/A-Fizzy-Rock/Looking-Closer/Cold-seep-communities); Right: http://ferrebeekeeper.wordpress.com/tag/cold/)

Mud volcanoes are chemosynthetic ecosystems associated with tectonic phenomena, with shapes from amorphous mud pies to conical, with diameters from a few meters to kilometers, and heights up to 100 m (Dimitrov, 2002). Most of them occur in the seafloor and they are formed when overpressured sediments rich in gas, located inside the crust are exuded. The higher mud volcanoes are located in the

Moroccan coast, specifically in the Gulf of Cadiz (Pinheiro *et al.*, 2003). Such as hydrothermal vents, mud volcanoes also host a huge variety of chemosynthetic and symbiotic organisms (Roy *et al.,* 2004).

Although investigation of the deep sea has been greatly developing in last years, it is still a vast unknown environment, and in many ways we know more about the surface of Mars than we know about the deep ocean. Certainly there is still many species and new habitats to discover.

1.3. Class Polychaeta

Polychaetes are bristle bearing segmented worms (Figure 8) that belong to the Phylum Annelida and the Class Polychaeta (Glasby *et al.,* 2000). The name "polychaeta" derives from the Greek and means "poly-many"+"chaeta- bristle".

Figure 8. Polychaete specimens. From left to right: 1. *Myrianida pachycera* (Author: Greg Rouse). 2. *Spirobranchus giganteus* (Author: Nhobgood Nick Hobgood). 3. Nereid worm (Author: Peter J. Bryant).

These invertebrate animals inhabit our planet from a long time ago, since Pre-Cambrian and Cambrian eras (Fauchald, 1984) and since then they have created evolutionary strategies (morphological, feeding and reproductive habits) to adapt to this constant changing planet. They are an abundant and speciose group in marine ecosystems (over 10,000 described species), but there are still little few studies about them (Hutchings & Fauchald, 2000; Jirkov, 2001; Rouse & Pleijel, 2001; Quijón & Snelgrove, 2005). They have a worldwide distribution in coastal areas (estuaries, shallow reefs, mangroves) and are one of the most dominant groups of organisms in the continental shelf and in the deep sea (Grassle & Maciolek, 1992). In terms of depth, they distribute from intertidal zone to hadal depths (there are records from more than 10,000 m depth), and they are commonly benthic, although their larvae and some adults are pelagic (Paiva, 2006). Some species are extremophiles living at extreme conditions such as high temperatures and pressure, near hydrothermal vents.

In terms of reproduction polychaetes are mostly dioecious organisms, which mean that they have separate sexes and external fertilization. Some species release larvae to the water column allowing a higher spreading through the oceans (Paiva, 2006).

Polychaetes life style seems to be related to the way they capture food, thus, most of them are depositivores, feeding from rich organic matter areas (mangroves, estuaries and bottom of continental shelves). There are also suspension feeders that feed on microscopic organisms and particles in the water column, or within the plankton. Typically those polychaetes live in their own made tubes fixed to a substrate, for instance rocks and crevices, or buried in sediments, and are considered sedentary polychaetes because they almost do not move from the tube except to catch their preys, and consequently they have poorly developed or even absent sensorial organs and locomotion structures (parapodia). Others have an errant life style and are considered errant polychaetes. Those polychaetes are free living forms with more developed parapodia, and some species are able to swim in the water column or above sediments thus having high mobility and, as a consequence, well developed eyes, sensorial organs and parapodia (Fauchald, 1977; Glasby *et al.,* 2000; Paiva, 2006). Errant polychaetes are commonly carnivores showing a well developed buccal system such as jaws and tooth. They can also be symbiotic with many echinoderms, crustaceans, or even other polychaetes, herbivores and omnivores (Martin & Britayev, 1998, Fauchald & Jumars, 1979; Paiva, 2006). Many polychaetes are considered good biological indicators of pollution, due to their high resistance to organic and/or contaminant loads, revealing in this way an important ecological role (Reish, 1979).

Polychaetes length varies from less than a millimeter until more than 10 meters and its morphological variety reflects their different life styles (Glasby *et al.,* 2000; Glasby & Timm, 2008). Morphologically polychaetes are characterized by having a segmented body subdivided in four parts: the prostomium or head that bears eyes and sensorial organs such as palps and antennae; the peristomium, a short region surrounding the mouth; the metastomium, with parapodia bearing bristles used in locomotion and gills (in some taxa) used in respiration; and a posterior part, the pygidium, where is the anus (Figure 9).

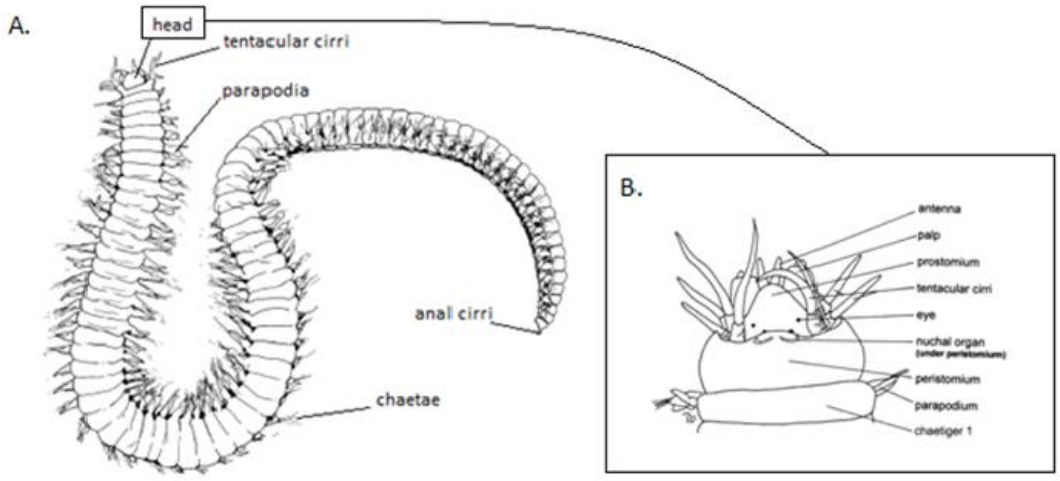

Figure 9. General scheme of polychaetes anatomy. A. *Namanereis cavernicola*, (after Glasby, 1999: Fig. 8c). B. Dorsal view of the head of *Nereis virens* (source: http://lanwebs.lander.edu/faculty/rsfox/invertebrates/nereis.html).

1.3.1. Order Phyllodocida

Phyllodocida is a polychaete order erected by Dales in 1962. Previous to Dales, no one considered the Phyllodocida as a monophyletic group and some species were included within other groups like the eunicids, for example. The strong monophyletic condition of this order was only later confirmed by Rouse and Fauchald (1997). These authors corroborated this idea based on some typical morphological characteristics such as the ventral position of sensory palps, the presence of an axial muscular proboscis and the presence of compound chaetae with single ligament. In total 28 families were included by these authors in this order and, in opposition to other authors, they also included here the Myzostomida. In 1998, Pleijel and Dahlgren erected two clades within Phyllodocida: Nereidiformia and Aphroditiformia. Nowadays, the Phyllodocida order is subdivided in four suborders: Aphroditiformia, Glyceriformia, Nereidiformia and Phyllodociformia, plus some Phyllodocida incertae sedis (Table 1). It is difficult to assess the exact number of species within this order but there are more than 3,500 species.

Table 1. Different suborders and respective families within Phyllodocida order.

Suborders	Aphroditiformia	Glyceriformia	Nereidiformia	Phyllodociformia
Families	Acoetidae Kinberg, 1856	Glyceridae Grube, 1850	Antonbruunidae Fauchald, 1977	Lopadorrhynchidae Claparède, 1868
	Aphroditidae Malmgren, 1867	Goniadidae Kinberg, 1866	Chrysopetalidae Ehlers, 1864	Phyllodocidae Örsted, 1843
	Eulepethidae Chamberlin, 1919	Lacydoniidae Bergström, 1914	Hesionidae Grube, 1850	Pontodoridae Bergström, 1914
	Iphionidae Kinberg, 1856	Paralacydoniidae Pettibone, 1963	Nereididae Blainville, 1818	
	Pholoidae Kinberg, 1858		Pilargidae de Saint-Joseph, 1899	
	Polynoidae Malmgren, 1867		Syllidae Grube, 1850	
	Sigalionidae Malmgren, 1867			

The majority of the phyllodocids live in association with marine sediments, algal mats and rocks and have a wide distribution from the intertidal to extreme depths (Beesley *et al.*, 2000). However they can also occur in brackish waters and may even be present in freshwater and terrestrial habitats. Most phyllodocids are active animals but some of them have more sessile life styles. They usually live near the bottom, although there are some pelagic forms. Their size is very variable, ranging from a few millimeters to over a meter in length, and usually have bright colors, with different pigmentation patterns (Figure 10).

Figure 10. Phyllodocid's. From left to right: 1- *Neanthes vaalii* (Author: Greg Rouse); 2-*Phyllodoce lineata* (Author: Hans Hillewaert); 3- *Eulalia viridis* (Author: Ricardo R. Fdez).

2. OBJECTIVES

This work aimed at the study of the polychaete order Phyllodocida in the reported areas providing the most detailed taxonomic approach possible, and also ecological remarks on the distribution of the species. In order to achieve these objectives many stages have been done:

- bibliographic research of the families Acoetidae, Glyceridae, Goniadidae, Pholoidae, Phyllodocidae, Polynoidae and Sigalionidade;
- taxonomical study of the specimens in each family by a thorough review of their identification and classification;
- assessment of the geographic and bathymetric ranges of the examined species and remarks on their habitats.

Note: The sub-order Nereidiformia was not approached in this study due to time constrains.

3. METHODOLOGY

3.1. Oceanographic cruises and studied areas

During the years 2000 until 2012 several oceanographic cruises were carried out to study deep-sea ecosystems along the European margins in the scope of the Training Through Research (TTR) program (UNESCO-IOC), the projects HERMES and HERMIONE (EC 6th FP and 7th FP), CHEMECO and REDECO (ESF), SWMGLO (FCT), Microsystems and MOUNDFORCE. Biological sampling was especially relevant in cold seeps and cold-water coral settings along the Iberian Margin (Bay of Biscay, Horseshoe Continental Rise, Gulf of Cadiz, and Alboran Sea), which are the main target of this work (Table 2). Additional material collected in a few sites from Atlantic Seamounts and deep-water locations around Crete (Eastern Mediterranean Sea), is also included (Figure 11). The complete list of stations that yielded Phyllodocida specimens, their respective metadata together with some ecological notes (when applicable) is displayed in Annex I.

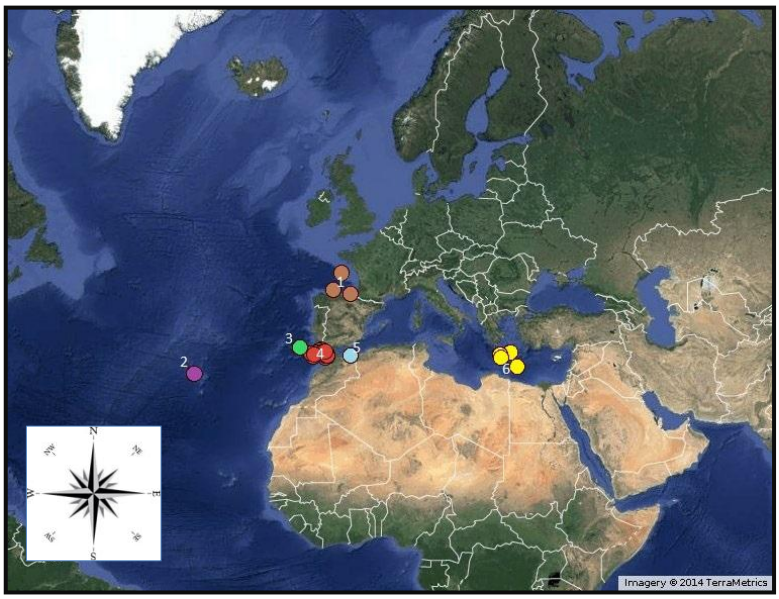

Figure 11. Geographic location of the oceanographic cruises in this study. 1. Bay of Biscay. 2. Atlantis Seamount. 3. Gorringe Bank. 4. Gulf of Cadiz. 5. Alboran Sea. 6. East Mediterranean.

The Bay of Biscay is characterized by hard substrates such as rocks, flanks of oceanic banks, moraine ridges, seamounts and sedimentary mounds. Numerous canyons cut the continental slope of the bay: Cap Ferret, Cap Breton, St. Nazaire, among others. Other structures are geologically relevant such as Le Danois Bank and the Pajès escarpment (Flögel *et al.*, 2011; De Mol *et al.*, 2011). The St. Nazaire

and Cap Breton canyons are biologically characterized by the presence of cold-water corals mostly *Madrepora oculata* and *Lophelia pertusa* at depths around 50 to 1000 meters (De Mol *et al.*, 2011).

The Gorringe Bank, located in the east Atlantic Ocean (SW of Portugal), is composed by two distinct seamounts, Gettysburg and Ormonde, that rise from the Horseshoe Abyssal Plain, at depths greater than 5,000 m, to a few tens of meters below sea level. These seamounts are uplifted blocks of the oceanic crust and mantle, formed during seafloor spreading several million years ago (Bell *et al.*, 2012). Other Atlantic seamounts sampled only occasionaly include the Atlantis (Azores EEZ) and Nameless (Madeira EEZ).

Table 2. Main target areas of the oceanographic cruises mentioned in this work. BB- Bay of Biscay; GoB- Gorringe Bank; HCR – Horseshoe Continental Rise; GC- Gulf of Cadiz; AS- Alboran Sea; EM- East Mediterranean.

Areas	Cruises	RV	Dates	Projects
BB	M84-5	*Meteor*	May - June 2011	HERMIONE
GoB	NA017	*Nautilus*	October 2011	Ocean Exploration Trust
HCR	M86-5	*Meteor*	February - March 2012	SWIMGLO
GC	TTR11	*Prof. Logachev*	August - September 2001	TTR
	TTR12	*Prof. Logachev*	July - August 2002	TTR
	TTR14	*Prof. Logachev*	August - September 2004	TTR
	64PE237	*Pelagia*	May - June, 2005	Moundforce
	TTR15	*Prof. Logachev*	July- August 2005	TTR
	MSM 01/03	*Maria S. Merian*	April - May 2006	HERMES
	TTR16	*Prof. Logachev*	May - July 2006	TTR
	64PE253	*Pelagia*	September - October 2006	Microsystems
	64PE268	*Pelagia*	April - May 2007	Microsystems
	JC10	*James Cook*	May - July 2007	HERMES
	64PE284	*Pelagia*	February - March 2008	HERMES
	TTR17-2	*Prof. Logachev*	June-July 2008	TTR
	B09/14b	*Belgica*	May 2009	CHEMECO
AS	TTR17-1	*Prof. Logachev*	June, 2008	TTR
EM	REDECO	*Aegaeo*	June 2010	REDECO
	REDECO	*Aegaeo*	June 2011	REDECO

The Gulf of Cadiz is an extensive seepage area located in the east Atlantic Ocean, enclosed by the southern Iberian margin and the northern margin of Morocco. It comprises over 40 mud volcanoes (e.g. Bonjardim, Captain Arutyunov, Carlos Ribeiro, Jesus Baraza, Mercator, Meknès, Kidd, TTR) at depths ranging from 200 to 4,000 m with a rich associated fauna (Cunha *et al.*, 2013). The seepage

area further extends westards, along the SWIMGLO faults, into the Horseshoe Continental Rise where deeper mud volcanoes were recently discovered.

The Alboran Sea is located in the western Mediterranena Sea, encompassed by the Andalusian margin (North), the Gibraltar Strait (West), and the Moroccan margin (South), and is a large and relatively shallow basin (depth does not exceed 2,000 m). The basin seafloor has a complex topography with ridges, coral and carbonate mounds, pockmarck's and mud volcanoes (e.g., Mulhacen, Dhaka, Maya). The western part of the basin has a remarkable mud-diapir province, the Carbonate Mound Field of Melilla (Margreth *et al.*, 2011).

3.2. Sample collection and processing

The study sites include several mud volcanoes and other locations from adjacent habitats (carbonate mounds and cold-water coral reefs), but also seamounts and submarine canyons, covering a depth range from 214 to 4864 m (Annex I and II). The biological material from the studied areas was obtained during several cruises (Table 2) carried out from 2000 to 2012 and include a series of samples taken with a diverse array of quantitative and non-quantitative sediment samplers (Table 3): box-corers, TV-grabs and multicorers. Samples were also recovered from lander operations (BIGO and FLUFO chambers) and ROV dives (suction, scoop and push-cores and suction samples). Geological dredge samples and rocks collected during ROV dives provided some specimens of mostly epibenthic sessile organisms. Samples were processed onboard: the washed sediment samples and animals sorted onboard were fixed in 96% ethanol and kept for further examination in the lab.

Note: the sample collection and processing were not made by the author of this study.

Table 3. List of gears used during the cruises.

Gear	Abbreviation	Main target
Dredge	D	Bio/Geological
USNEL Boxcorer	UB	Bio/Geological
NIOZ Boxcorer	NB	Bio/Geological
Multicorer	MUC	Biological
Colonization devices	CHEM	Biological
BIGO Lander	BG	Biogeochemical
FLUFO Lander	FL	Biogeochemical

4. SYSTEMATICS

Suborder Aphroditiformia

Aphroditiformia is a large suborder group that includes all the scale-worms. The group comprises seven families (Acoetidae, Aphroditidae, Eulepethidae, Pholoidae, Polynoidae, Iphionidae, Sigalionidae) divided into over 200 genera and about 1200 polychaete species (Norlinder *et al.*, 2012). The name Aphroditiformia is due to the genus *Aphrodita,* one of the first polychaeta genera being described by Linnaeus (1758).

The main characteristic of these polychaetes is the presence of scales, or elytra, located on the dorsal side and above the parapodia. Sometimes these structures are misunderstood with dorsal cirri, since they tend to alternate with each other (dorsal cirri are present on all segments without elytra). The elytra may addopt many shapes and serve different functions, like respiration and sensory perception (Pettibone, 1953). Sensory role is due to their numerous complex papillae with sensory structures.
The cladistic analysis made by Rouse and Fauchald in 1977, clarified the relations between some taxa, and in 2001, Rouse and Pleijel comprised the families Acoetidae, Aphroditidae, Eulepethidae and Polynoidae into the superfamily Aphroditoidea, and proposed much similarity between the families Acoetidae and Aphroditidae. Sigalionidae was considered by these authors as the sister group of Aphroditoidea, and the basal group was the family Pholoidae (Struck *et al.*, 2005). Actually the results indicate that the Aphroditidae and Eulepethidae are the most basally placed families among the scale-worms and the families Pholoididae and Pisionidae are synonymized with the Sigalionidae, and Pholoidae may be part of the same group. The subfamily Iphioninae is now a sister group to a clade consisting of Polynoidae and Acoetidae families, and was elevated to the Iphionidae family. The families now included in the Aphroditiformia are Acoetidae, Aphroditidae, Eulepethidae, Pholoidae, Polynoidae, Iphionidae and Sigalionidae. The subfamily name Harmothoinae and Acholoinae are treated as junior synonyms of Polynoinae (Norlinder *et al.*, 2012).

Aphroditids are usually epi- and infaunal on hard and soft substrate, from intertidal zones to abyssal depth, and occur worldwide. Several polynoid species are commensals on a variety of hosts including echinoderms, cnidarians, polychaetes, bivalves and decapods (Struck *et al.*, 2005; Norlinder, 2013).

Family Acoetidae Kinberg, 1856

Acoetidae includes at present 10 genera and 60 species of scaleworms (WoRMS database - http://www.marinespecies.org/polychaeta/). This family was previously known as Polyodontidae Augener, 1918, and later renamed as Acoetidae by Pettibone (1989a). That author presented the only comprehensive revision along with a historical review of the family. Recent revisions for Europe include Ben-Eliahu and Fiege (1994), Barnich and Fiege (2003) and Palmero *et al.* (2008), the first two, to the Mediterranean and the latter, to the Iberian Peninsula.

Acoetids can occur from the intertidal to the deep sea, although they are more common from moderate to around 1500 m depth, in soft sediments (Rouse & Pleijel, 2001; Palmero *et al.,* 2008). Apart from the Antarctic, there are records from around the world, although the majority is from warm waters in temperate and tropical areas (Rouse & Pleijel, 2001). These worms tend to be large and live in self-made permanent tubes (made with the help of spinning glands located on the parapodia) that often harbour a number of invertebrate commensals. They are passive predators, never leaving their tubes completely (Pettibone, 1989a; Rouse & Pleijel, 2001; Palmero *et al.,* 2008).

Acoetid's body is long and has many segments. They can reach up to one meter or more (Pettibone, 1989a) (Figure 12). Their head is well-developed with long palps, antennae, tentacular cirri and eyes. Eyes are absent in manyspecies but some have large stalked eyes, or ommatophores (Figure 13).

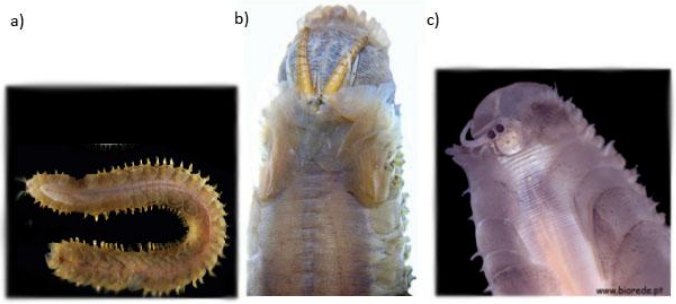

Figure 12. Acoetid specimens. a) *Panthalis oerstedi* (from Norlinder *et al.*, 2012); b) Anterior end of *Euarche rudipalpa* (from Salazar-Vallejo *et al.*, 2014); c) *Panthalis* sp. (source: http://www.biorede.pt/image.asp?id=3717).

Their pharynx is strong and muscular and have a circlet of sensory papillae, and two pairs of strong jaws. Their dorsum is covered by elytra that exist all over the body, alternately from the second segment, with the exception of fourth and fifth segments, in where they occur successively. Notopodium have spinning glands. Chaetae are unjointed and can be capillary, acicular, "bipinnate",

sickle or lance shape, unidentate, serrated or hairy. Pygidium has a pair of anal cirri (Chambers & Muir, 1997).

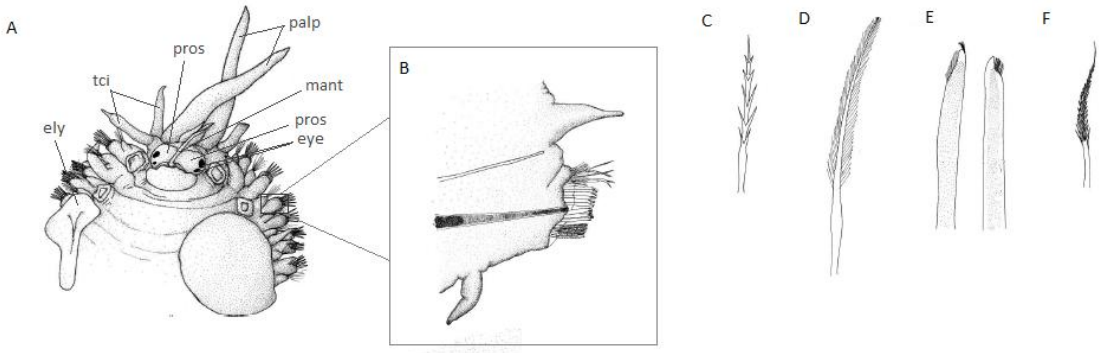

Figure 13. Representative scheme of Acoetid morphology, *Euarche tubifex*. A. Anterior end, dorsal view. B. Parapodium of a medium segment, anterior view. C. Spiked neurochaeta of the upper bundle. D. Distally spinigerous neurochaeta of the upper bundle. E. Acicular neurochaeta of the middle bundle. F. Curved, spinigerous neurochaeta of the lower bundle. Legend: ely - elytrophore; eye - eye; palp - palp; mant - median antenna; pros - prostomium; tci - tentacular cirri (after Palmero *et al.*, 2008).

- **Genus *Panthalis* Kinberg, 1856**

Panthalis Kinberg, 1856 p. 386.

Type species. *Panthalis oerstedi* Kinberg, 1856.

Brief description. Prostomium oval with a pair of lateral antennae inserted ventrally on ommatophores, a median antenna located centrally, and a pair of long smooth ventral palps. Distal border of pharynx with up to 15 pairs of papillae and 2 pairs of hooked jaws, each with up to eighteen lateral teeth. Elytra delicate and transparent, on segments 2, 4, 5, 7, continuing on alternate segments. Tentacular segment visible dorsally. Biramous parapodia. Dorsal cirri with short cirrophores and short styles. Ventral cirri short, tapered. Neurochaetae acicular from third segment. Neurochaetae of superior part curved spinigerous lanceolate and longer, with plumose tips and shorter, bipinnate on inferior part. Pygidium with a pair of cirri (Pettibone, 1989a).

***Panthalis oerstedi* Kinberg, 1856**

Panthalis oerstedi Kinberg, 1856 p. 387; Kinberg, 1858 p. 25, pl. VII, fig. 34a-h, pl. X, fig. 60; McIntosh, 1876a p. 389; McIntosh, 1900 p. 400; Fauvel, 1923 p. 98, fig. 38;Chambers, 1985 p. 34; Pettibone 1989a p. 53, figs. 32-34; Ben-Eliahu & Fiege, 1994 p. 156, figs. 8f, 9a-c; Hartmann-Schröder, 1996 p. Chambers & Muir, 1997 p. 138, fig. 43; Barnich & Fiege, 2003 p. 101, fig. 52.

Material examined. Atlantic Ocean. Gulf of Cadiz (MV): Captain Arutyunov, St MSM01-3_180, 1323 m, 1 spm.

Brief description. Prostomium with a median antenna in a large ceratophore, a pair of lateral antennae below eye stalks, and a pair of long papillated palps. Peristomium with a few capillary chaetae between the dorsal and ventral tentacular cirri. Elytra rounded and small on first segments and on the following larger and irregular. They occur on segments 1, 3, 4 and 6 and then alternately to the end of body. Spinning glands from eighth chaetiger. Notochaetae all capillaries. Neurochaetae spinigerous capillaries, stout tapering to a fine point with a spinigerous outer dorsal tip, scythelike unidentates with spinigerous inner curved edge and fine brush-tipped unidentates. Pygidium with a pair of cirri (Chambers & Muir, 1997).

Habitat. Mud, sand, shell and shell sand bottoms. Sub-littoral until 1470 m depth (Ben Eliahu & Fiege, 1994).

Distribution. North East Atlantic Ocean (from Skagerrak, to Northwest Africa), Mediterranean Sea (Pettibone, 1989a; Ben Eliahu & Fiege, 1994; Chambers & Muir, 1997; Palmero *et al.*, 2008).

Remarks. Although this species is known to occur from Norway to the Mediterranean, only a few records are known for the Atlantic European coast below the North Sea (Campoy, 1982 – Iberian Peninsula from Galiza to Gibraltar; Palmero *et al.*, 2008 – Cap Breton). In this study, only one large and incomplete specimen was examined, from the Gulf of Cadiz, 1323 m depth.

Family Pholoidae Kinberg, 1858

The family Pholoidae comprises at present 5 genera: *Imajimapholoe* Pettibone, 1992a, *Laubierpholoe* Pettibone, 1992a, *Metaxypsamma* Wolf, 1986, *Pholoe* Johnston, 1839 and *Taylorpholoe* Pettibone, 1992a and 23 species (WoRMS database - http://www.marinespecies.org/polychaeta/). The genus *Pholoe* was revised by Pettibone in 1992a and two new species (*Pholoe longa* Müller, 1776) and *Pholoe polymorpha* (Hartmann-Schröder, 1962) were redescribed. According to Pettibone, many genera of Pholoidae were incorrectly placed under many families such as Sigalionidae Kinberg, 1856, Acoetidae Kinberg, 1856, Polyodontidae Augener, 1918 (presently Acoetidae), Peisidicidae Hartman and Fauchald, 1971 and Pholoididae Fauchald, 1977.

Pholoids have a vast world distribution in all kind of substrata from low depths to several thousand meters (Pettibone, 1992a) (Figure 14). They are active predators and capture mainly invertebrates (Fauchald & Jumars, 1979). In terms of size Pholoidae are much smaller than the Sigalionidae. Their colors vary from white to yellowish, sometimes with dark pigmentation.

Figure 14. *Pholoe assimilis* Örsted, 1845 (by M. Kędra & S. Gromisz)

Their prostomium is rounded and often incised at, or above the insertion of the median antenna, and has a pair of eyes, a pair of palps, and sometimes a pair of small antennae. The pharynx is muscular and has two pairs of "piercing" jaws and a distal ring of nine dorsal and nine ventral papillae. On the following segments neurochaetae are compound. Branchiae are absent. Elytra are present on segments 2, 5 and 7 and alternately to the 23th segment. Pygidium with a single pair of anal cirri (Figure 15) (Rouse & Pleijel, 2001).

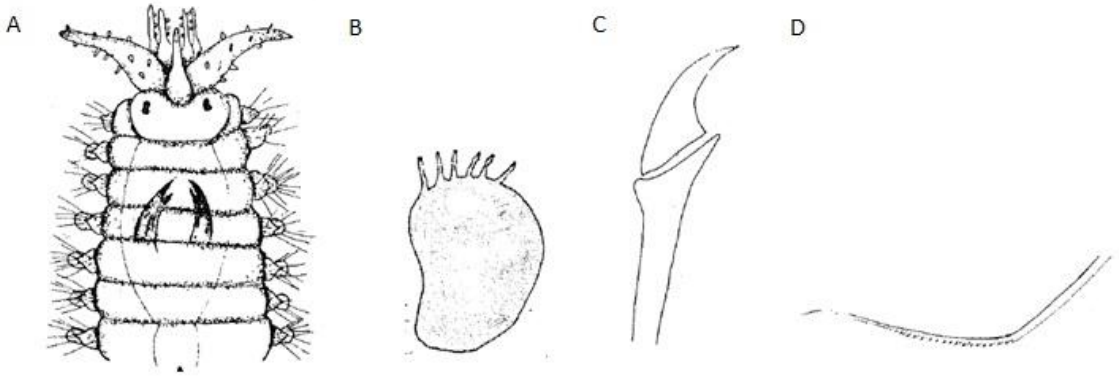

Figure 15. Representative scheme of Pholoid morphology. A. Anterior end, dorsal view. B. Elytron. C. Simple chaetae. D. Compound chaetae (after San Martin *et al.*, 1981).

- **Genus *Pholoe* Johnston, 1839**

Pholoe Johnston, 1839 p. 437.

Type species. *Aphrodita minuta* Fabricius, 1780

Brief description. Prostomium rounded with a median antenna without auricles, with or without lateral antennae, a pair of palps and two pairs of eyes sometimes fused or absent. Pharynx with 9 dorsal and 9 ventral border papillae, and 2 pairs of jaws. Elytra with border and surface papillae. First segment fused to prostomium. Biramous parapodia. Dorsal cirri absent. Ventral cirri short and tapered. Notochaetae strongly dentate. Neurochaetae compound, with shafts spinigerous subdistally and blades short, spinigerous, falcigerous, and unidentate. Pygidium with a pair of cirri (Pettibone, 1992a; Fauchald, 1977; Chambers & Muir, 1997).

***Pholoe fauveli* Kirkegaard, 1983**

Pholoe fauveli Kirkegaard, 1983a p. 599, fig.1.

Material examined. Atlantic Ocean. Bay of Biscay: St. Nazaire Canyon, St. M84-5_644, 825 m, 1 spm (cf.); St M84-5_649, 1105 m, 8 spm; St M84-5_651, 982 m, 4 spms (1 cf.).

Brief description. Prostomium oval with two large eyes, a small median antenna, two short subulate palps, and two pairs of tentacular cirri. Elytra with a few large papillae on surface and a row of 10-12 similar pointed papillae along the edge. First pair of elytra oval and the remaining reniform. Parapodia and ventral surface covered with small papillae. No chaetae on the segment with tentacular cirri. Notochaetae thin and numerous, neurochaetae much stouter and compound. Terminal blades of neurochaetae short in median chaetigers and longer and finely dentate anteriorly and posteriorly. Pygidium with a pair of cirri (Kirkeggard, 1983a).

Habitat. From 800 to 1350 m depth (Kirkeggard, 1983a).

Distribution. Northeast Atlantic (Bay of Biscay, Azores) (Kirkeggard, 1983a).

***Pholoe pallida* Chambers, 1985**

Pholoe pallida Chambers, 1985 p. 21, fig. 13c-d, 18e-h, plates A3-4, B3-4; Chambers & Muir, 1997 p. 166, fig. 54.

Pholoe cf. *anoculata*: Christie, 1982 p. 283-291. [Not *P. anoculata* Hartman, 1965b.]

Material examined. Atlantic Ocean. Gulf of Cadiz (MV): Darwin MV, St B09-14b_02W, 1100 m, 1 spm (cf.); **Captain Arutynov MV**, St TTR14_AT546, 1345 m, 3 spms (cf.); St MSM01-3_180, 1323 m, 3 spms

(cf.); St MSM01-3_190.1, 1322 m, 3 spms (cf.); St MSM01-3_218, 1318 m, 13 spms (cf.); St. MSM01-3_225, 1320 m, 1 spm (cf.); St MSM01-3_274, 1321 m, 1 spm (cf.); **Carlos Ribeiro MV**, St MSM01-3_184, 2233 m, 1 spm (cf.).

Brief description. Prostomium triangular, median antenna with a ceratophore. First pair of elytra oval and the remaining reniform to oval with erect moniliform papillae in the outer margins. Eyes absent. Scales on first segments rounded and on posterior ones oval to kidney-shaped with flask-shaped papillae on surface. Two ctenidial cushions on the second segment. Notochaetae fine capillaries and shorter geniculate capillaries. Neurochaetae with thin blades undientate tips and smooth spinigerous shafts. Short pair of anal cirri (Chambers & Muir, 1997).

Habitat. Sub-littoral (Chambers & Muir, 1997).

Distribution. North Sea (Scotland, Danmark) (Chambers, 1985; Chambers & Muir, 1997; Petersen, 1998).

Remarks. *Pholoe pallida* was first described from off St. Abbs (Scotland) and up to date it is only known from the North Sea area at near-shore depths (Chambers & Muir, 1997; Petersen, 1998), although Chambers (1985) refers to a possible confusion between this species and *P. minuta*, and that all records of the latter require revision. This is the only known European species that lack eyes. The specimens examined in this study are from the Gulf of Cadiz, 1100 to 2233 m depth. All the specimens lack eyes, but slight differences were detected on the papillae of the elytra and on the length of the neurochaeta blades (longer in the specimens examined), when comparing to *P. pallida*. However, due to the small size of the specimens, these characteristics can only be evaluated with certainty under electronic microscopy. Therefore, these specimens need further revision. There is another species, from Northwest Atlantic, *P. anoculata*, that lack eyes and should also be taken in consideration. Previous records of this species from off Northumberland (UK) (Christie, 1982) were mistaken and later transferred to *P. pallida* (Chambers, 1985).

Family Polynoidae

Polynoidae is one of the most speciose of all polychaete families and includes at present 16 subfamilies: Admetellinae Uschakov, 1977, Arctonoinae Hanley, 1989, Bathymacellinae Pettibone, 1976, Branchinotogluminae Pettibone, 1985, Branchipolynoinae Pettibone, 1984, Eulagiscinae Pettibone,

1997a, Gesiellinae Muir, 1982, Lepidastheniinae Pettibone, 1989b, Lepidonotinae Willey, 1902, Lepidonotopodinae Pettibone, 1983, Macellicephalinae Hartmann-Schröder, 1971, Macelloidinae Pettibone, 1976, Polaruschakovinae Pettibone, 1976, Polynoinae Kinberg, 1856, Uncopolynoinae Wehe, 2006 and Vampiropolynoinae Marcus & Hourdez, 2002 (Figure 16). Pettibone, in 1982, recorded about 120 genera and 600 species, and since then about 815 species in 167 genera are known worldwide (Wehe 2006). The first polynoid species were described by Müller in 1776 as belonging to the genus *Aphrodita*. In 1977, Fauchald recognized four subfamilies within the family and since then many additional subfamilies have been added, especially by authors such as Pettibone (1976, 1989c, 1996) and Hanley (1989), although they have not been widely used.

Polynoid's occur worldwide from the tropics to the Antarctic and the Arctic, from shallow to deep waters, even to abyssal and hadal depths (Hartman, 1971), both in soft and hard substrata and many are restricted to cold-water coral reefs (Beesley *et al.*, 2000; Fiege & Barnich, 2009). More than 200 species are symbiotic and are often found associated with echinoderms and tube- or burrow-building animals (Pettibone, 1993, Martin & Britayev, 1998, Britayev *et al.*, 2013). They are commonly known has carnivores being motile predators/scavengers playing an important role in the habitats, (Fauchald and Jumars 1979; Pettibone 1982; Fiege & Barnich, 2009). In terms of reproduction, polynoids are dioecious having separate sexes.

Figure 16. Polynoid specimens. Left: *Harmothoe* sp. (Author: Tatiana Menchini Steiner, source: http://www.ib.unicamp.br/site/museu_zoologia/harmothoe_sp); Right - *Branchipolynoe pettibonae* Miura & Hashimoto, 1991, source: http://chess.lifedesks.org/pages/47884).

Morphologically, polynoids have a well-developed head, with many sensory structures. The prostomium is bilobed, with from one to three antennae on ceratophores; simple notochaetae and neurochaetae, and two pairs of eyes, which can be absent. The peristomium is reduced to lips around the mouth. The first segment has lateral tentaculophores and parapodia with a single acicula, notochaetae can be present or not and there is a pair of ventral and dorsal tentacular cirri. The pharynx

has terminal papillae and two pairs of jaws. Paired elytrae or scale-like dorsal structures occur alternatively with dorsal cirri on segments 2, 4, 5, 7, 9 …21, 23, and irregularly afterwards. In terms of ornamentation, they may be smooth or covered with micro- or macrotubercles, with fringed or smooth margins. Some elytra are distinctively pigmentated and even luminescent (Plyuscheva & Martin, 2009). Branchiae are usually absent, but some species have digitiform branchial filaments. Parapodia are biramous and both notopodia and neuropodia are equally developed, but the neuropodia is usually longer in all segments. The dorsal cirri are present in the segments without elytra and their shapes vary from inflated and bulbous distally, forming pseudo-elytra, or distally bifurcated. The ventral cirri are usually short. Chaetae are capillary and spinigerous and vary greatly in number, ornamentation and size. The pygidium bears a pair of pygidial cirri (Rouse & Fauchald, 1997; Salazar-Silva, 2006; Hutchings, 2000b) (Figure 17).

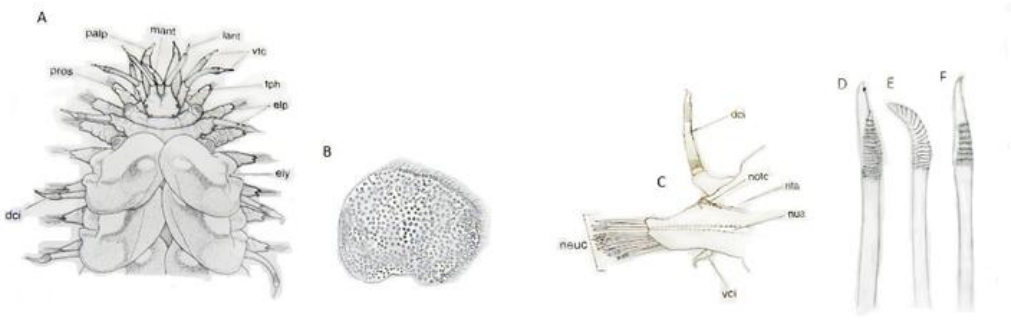

Figure 17. Representative scheme of Polynoid morphology. A. Anterior end of *Lepidonotus melanogrammus*, dorsal view. B. Elytra. C. Anterior view of a parapodium. D. Bidentate Neurochaetae. E. Notochaetae. F. Unidentate neurochaetae. Legend: dci - dorsal cirrus; elp - elytrophores; ely - elytron; mant - median antenna; notc - notochaetae; neuc - neurochaetae; nua - neuroacicula; palp - palp; pros - prostomium; lant - lateral antennae; vci - ventral cirrus; tph- tentaculophore; tci - tentacular cirri (after Hutchings, 2000b).

- **Genus *Acanthicolepis* Norman *in* McIntosh, 1900**

Dasylepis Malmgren, 1867 [name preoccupied by Silurian ganoid, cf. McIntosh 1900].

Type Species. *Polynoe asperrima* M. Sars, 1861.

Brief description. Body short and flattened dorsoventrally with around 43 segments, covered by eighteen pairs of elyra on segments 2, 4, 5, 7, 9, 11, 13, 15, 17, 19 , 21, 23, 26, 29, 32, 34, 35, and 38. Prostomium with distinct cephalic peaks, a pair of antennae and a median one, a pair of palps and two

pairs of eyes. Ceratophore of median antenna in anterior notch. Ceratophores of lateral antennae inserted ventrally. Pharynx with fourteen pairs of lateral papillae and two pairs of hooked jaws. Second segment with the first pair of elytra, biramous and with long ventral cirri. Elytra of the first segments rounded, the following oval or kidney-shaped. Their surface ornamented with tubercles and few papillae, and their margins with fringing papillae. Dorsal cirri present on segments lacking elytra with cylindrical cirrophores. Ventral cirri short. Notochaetae stouter than neurochaetae, with distinct rows of spines and sharp tips. Neurochaetae with distinct rows of spines (only distally) and two kinds of tips: unidentate and bidentate, with secondary tooth subdistally. Pygidium with a pair of anal cirri (Barnich *et al.*, 2000).

***Acanthicolepis asperrima* (M. Sars, 1861)**

Polynoe asperrima M. Sars, 1861 p. 59.
Dasylepis asperrima Malmgren, 1867, p. 132; McIntosh, 1876a p. 374.
Acanthicolepis asperrima McIntosh, 1900: 311-312, pl. 27 fig. 6, pl. 32, fig. 4, pl. 37, figs. 28-30, pl. 42, fig. 29; Ehlers, 1908 p. 44; Fauvel, 1914 p. 52 [in part]; Rioja, 1918 p. 12, fig. 2; Fauvel, 1923 p. 85, fig. 32h-m; Laubier, 1961 p. 8, fig. 3d; Carpine, 1970 p. 54, 58,131,141; Amoureux, 1977 p. 393; Campoy, 1982 p. 51; Tebble & Chambers, 1982 p. 66, figs. 22, 58; Kirkegaard, 1983a p. 594; Kirkegaard, 1992 p. 35, fig. 8; Hartmann-Schröder, 1996 p. 38; Chambers & Muir, 1997 p. 74,fig. 11; Barnich *et al.*, 2000 p. 314; Barnich & Fiege, 2003; Fiege & Barnich, 2009 p. 150, fig. 1a-d.
Acanthicolepis asperrima var. Laubier, 1961 p. 8, fig. 3b,e.
Acanthicolepis cousteaui Laubier, 1961 p. 1, figs 1, 2, 3a,c; Laubier & Paris, 1962 p. 8.

Material examined. Atlantic Ocean. Bay of Biscay: Cap Breton, St M84-5_633, 221 m, 1 spm.

Brief description. Prostomium with distinct cephalic peaks, a pair of lateral antennae, a median antenna with large ceratophore in anterior notch and two pairs of eyes. Second segment with first pair of elytra, biramous parapodia and long ventral tentacular cirri. Elytra with few fringing marginal papillae, and surface covered with spines with simple, bifid, or multibifid tips and by few papillae on posterior half. Notochaetae stouter than neurochaetae, with distinct rows of spines and sharp tips. Neurochaetae with distinct rows of spines only in distal part, usually with unidentate, pointed tips, except for one middle neurochaetae with bidentate tip, with a minute secondary tooth (Barnich *et al.*, 2000).

Habitat. From 15 until 1360 m depth (Barnich *et al.*, 2000).

Distribution. Northeastern Atlantic (from Norway to Azores), northwestern Mediterranean Sea (from the Catalan coast to Monaco) (Barnich *et al.*, 2000).

Remarks. The only specimen examined herein is not complete but has most characteristics of *A. asperrima*. The genus *Acanthicolepis* has presently three described species: *A. asperrima* (M. Sars, 1861), *A. longicirrata* Treadwell, 1941 and *A. zibrowii* Barnich & Fiege, 2010, from which two can occur at the Bay of Biscay: *A. asperrima* and *A. zibrowii*. The species *A. zibrowii* described in 2010, by Barnich & Fiege, is relatively new, and was precisely described from the Bay of Biscay in deep-sea corals. Núñez *et al.,* 2011, specifically examined a specimen from Saint Nazaire canyon, at 1250 m depth. Those authors even refer another specimens belonging to Galizia bank, at 769 m depth, associated with the coral *M. oculata*.

- **Genus *Almaniella* McIntosh, 1885**

Almaniella McIntosh, 1885 p. 102.

Type Species. *Almaniella setubalensis* McIntosh, 1885 (type by monotypy).

Brief description. Body with 15 to 30 pairs of elytra. Prostomium bilobed with two large lobes, with small lateral antennae attached distally, a median antenna, a pair of palps well developed and two pairs of large eyes. Ceratophore of median antenna inserted in the middle of prostomium. Ventral cirri smooth. Neurochaetae unidentate, or bifid (without accessory teeth), rarely trifid. Notochaetae thick and finely serrated (Horst, 1915; Fauvel, 1923; Fauchald, 1977).

***Almaniella setubalensis* McIntosh, 1885**

Almaniella setubalensis McIntosh, 1885 p. 102, pl. XIV fig. 2, pl. XA figs. 3, 4.

Material examined. Atlantic Ocean. Bay of Biscay: St. Nazaire Canyon, St M84-5_644, 825 m, 3 spms; St M84-5_653, 753 m, 4 spms; St M84-5_689, 752 m, 5 spms; St M84-5_690, 755 m, 2 spms.

Brief description. Prostomium anteriorly divided in two well-marked lobes that terminate in elongated bluntly conical processes bearing antennae. Median antenna inserted medially on the prostomium. Two pairs of large eyes, the anteriormost larger than the other and located at the sides of the widest part of prostomium. Ventral cirri long, tapering, apparently smooth. Notochaetae with well developed spinigerous rows and boldly marked longitudinal striae. Neurochaetae slender, with elongated spinigerous regions, ending in curved smooth and slightly bifid tips (McIntosh, 1885).

Habitat. Mud, 859.5 m depth (McIntosh, 1885).

Distribution. Northeast Atlantic (Portugal - off Setubal) (McIntosh, 1885).

Remarks. McIntosh (1885) described this species upon a small anterior fragment of about 3 mm long, collected around 860 m depth off Setubal (W Portugal). The specimens examined here are all very small and also incomplete. Like McIntosh's specimen, our specimens also lack elytra.

- **Genus *Anotochaetonoe* Britayev & Martin, 2005**

Anotochaetone Britayev & Martin, 2005 p. 4083.

Type species. *Anotochaetonoe michelbhaudi* Britayev & Martin, 2005.

Brief description. Body with up to 47 chaetigers. Up to 20 pairs of elytra with prominent elytrophores on segments 2, 4, 5, 7, 9, alternate segments to 23, 26, 29, 32, 34, 37, 40, 43, 46, reaching the end of body. Prostomium bilobed, wider than long, without cephalic peaks, with a pair of palps, a pair of lateral antennae inserted ventrally on prostomium and a median antenna. Ceratophore of median antenna inserted in an anterior notch. Pharynx with nine pairs of papillae and two pairs of jaws. First segment with longer ventral cirri than following ones. Parapodia relatively long, sub-biramous, without notochaetae. Neurochaetae straight to falcigerous, with rows of spines distally and unidentate knob-like or bidentate tip. Dorsal cirri present on segments without elytra, with short cirrophores and a marked alternation in length. Ventral cirri short, gradually tapering, smooth. Globular ciliated papillae present ventrally between ventral cirri and basis of neuropodia. Pygidium with terminal anus and long, smooth anal cirri (Britayev & Martin, 2005).

***Anotochaetonoe* sp.**

Material examined. Atlantic Ocean. Gulf of Cadiz (MV): Al Idrisi MV, St 64PE253_46A, 228 m, 1 spm.

Remarks. The genus *Anotochaetonoe* includes at present only one species, *A. michelbhaudi* Britayev & Martin, 2005, described from Republic of Congo (tropical E Atlantic), at 70-180 m depth, on silt and silty sand. This species is reported as a symbiont of chaetopterid species of the genera *Spiochaetopterus* and *Phyllochaetopterus*, living inside the host tube with the dorsum in contact with the body of the host (Britayev & Martin, 2005). The only specimen examined herein was also found inside an empty

chaetopterid tube, both inside a larger tube hosted by a specimen of *Hyalinoecia tubicola* (O. F. Müller, 1776) (Onuphidae). Both tubes were partially filled of silty sediment. This specimen agrees overall with the generic brief description with the exception for the dorsal cirri that do not present a marked alternation in length. Unlike *A. michelbhaudi*, all the neurochaetae of our specimen are falcigerous and unidentate, with strong spinulation. Therefore, this specimen requires further attention with the description of a potentially new species for the genus *Anotochaetonoe*.

- **Genus *Gorgoniapolynoe* Pettibone, 1991**

Gorgoniapolynoe Pettibone, 1991 p. 688.

Type species. *Gorgoniapolynoe bayeri* Pettibone, 1991 p. 690, figs. 1, 2.

Brief description. Body with 33 to 63 segments. Fifteen pairs of elytra on segments 2, 4, 5, 7, alternate segments to 23, 26, 29 and 32. Anterior 1-3 pairs of elytra modified, with microtubercles and micropapillae, following elytra smooth, without tubercles. Prostomium with lobes rounded to subtriangular, with, or without small cephalic peaks, a median antenna with ceratophore in anterior notch and long distal style, short lateral antennae with distinct ceratophores inserted ventrally, removed from median antenna, a pair of tapering stout palps, and two pairs of eyes. Pharynx with nine pairs of border papillae and two pairs of jaws. First segment not distinct dorsally, tentaculophores lateral to prostomium, with two pairs of dorsal and ventral tentacular cirri. Second segment with first pair of elytrophores, biramous parapodia and long ventral cirri. Parapodia biramous, with notopodia subconical, shorter than neuropodia. Few notochaetae, extending only slightly beyond notopodia, smooth, acicular, about as stout as neurochaetae. Neurochaetae with faint spinigerous rows all or mostly all with bifid tips. Ventral cirri extending to about tips of neuropodia (Pettibone, 1991).

***Gorgoniapolynoe caeciliae* (Fauvel, 1913)**

Polynoe caeciliae Fauvel, 1913 p. 24, fig. 7A-D; 1914 p. 69, pl IV, figs. 1-6, 18-19; 1923 p. 82, fig. 31a-h; Belloc, 1953 p. 4; Hartmann-Schröder, 1985 p. 31, figs. 1-11 (part, not Indian Ocean).
Gorgoniapolynoe caeciliae Pettibone, 1991 p. 704, fig. 12

Material examined. Atlantic Ocean. Gorringe Bank: Gettysburg Seanount, 10-10-2011, St NA017_002, 2285 m, 1 spm; St NA017_046, 385 m, 1 spm.

Brief description. Prostomium bilobed wider than long, with rounded lobes, without cephalic peaks, with two pairs of large eyes, a median antenna, and a pair of palps stout, about as long as median

antenna. Ceratophore of median antenna in anterior notch, with long tapering style. Pharynx with nine dorsal and nine ventral border papillae and two pairs of jaws. Second segment biramous, with first pair of elytrophores. Few notochaetae, stout, acicular. Neurochaetae about as stout as notochaetae, with fine spinigerous rows and slightly hooked tips, mostly with small secondary tooth. Ventral cirri stout. Pygidium with a pair of long cirri (Pettibone, 1991).

Habitat. Associated with gorgonians, from 512 until 1543 m depth (Pettibone, 1991).

Distribution. Northeast Atlantic (Bay of Biscay, off Portugal, Madeira, Canary and Cape Verde islands); Northwest Atlantic (from off Georgia to Caribbean Sea).

Remarks. The two specimens examined herein are complete but without elytra. However, all other characteristics of the species *G. caeciliae* are present. The specimens were sampled in an area with gorgonian corals. These records extend the bathymetric distribution of this species to 385 – 2285 m depth.

- **Genus *Harmothoe* Kinberg, 1856**

Harmothoe Kinberg, 1856 p. 386.
Evarnella Chamberlin, 1919.

Type species. *Harmothoe spinosa* Kinberg, 1856.

Brief description. Body short, dorsoventrally flattened, with more than 50 segments. Fifteen pairs of elytra on segments 2, 4, 5, 7, on alternate segments to 23, 26, 29 and 32. Prostomium bilobed with distinct cephalic peaks, a pair of lateral antennae, a pair of palps, a median antenna with the ceratophore inserted in an anterior notch and usually two pairs of eyes. Anterior pair of eyes inserted anteroventrally on prostomium, beneath cephalic peaks, or dorsolaterally on widest part of prostomium, and the posterior inserted dorsally near hind margin of prostomium. Pharynx with 9 pairs of marginal papillae and 2 pairs of hooked jaws. First pair of elytra rounded and the following oval to kidney-shaped, with surface usually covered by microtubercles and macrotubercles and papillae may be present. Margins of elytra smooth or fringed. Dorsal cirri present on segments lacking elytra. Ventral cirri short. Notochaetae as stout as, or stouter than neurochaetae, with distinct rows of spines and blunt tips. Neurochaetae usually more numerous than notochaetae, with distinct rows of spines distally, and

usually bidentate, with secondary tooth subdistally, and unidentate with pointed tip. Pygidium with a pair of anal cirri (Pettibone, 1993; Barnich & Fiege, 2000).

Harmothoe **sp.**

Material examined. Atlantic Ocean. Bay of Biscay: St. Nazaire Canyon, St M84-5_688, 667 m, 4 spms (cf.); **Cap Breton,** St M84-5_678, 215 m, 1 spm. **Gulf of Cadiz (CC): SE of Yuma Carbonate Mound Province**, St 64PE284_12722, 907 m, 1 spm.

Remarks. Due to the small size or incomplete condition of these specimens, a determination to species level could not be accomplished. However, there are evidences that these specimens represent at least two different species.

***Harmothoe aspera* (Hansen, 1879)**

Polynoë aspera, Hansen, 1879 p. 1, pl. I; Théel, 1879 p. 10, pl. I, fig. 1-4; Hansen, 1882 p. 5, pl. II, fig. 10-15; Fauvel, 1914 p. 57.
Harmothoë aspera Levinsen, 1883 p. 36; Bidenkap, 1894 p. 52.
Harmothoe aspera Hartmann-Schröder, 1996 p. 44 [part; not *H. multisetosa* (Moore, 1902) according to Pettibone, 1953]; Barnich and Fiege, 2000 p. 1915.

Material examined. Mediterranean Sea. Alboran Sea (CS): Mulhacen MV, St TTR17-1_MS416, 365 m, 1 spm.

Brief description. Prostomium bilobed, with distinct cephalic peaks, a pair of lateral antennae with small ceratophores inserted ventrally, a median antenna with a large ceratophore in anterior notch, a pair of palps about as long as median antenna and two pairs of eyes, the anterior one inserted dorsolaterally on the widest part of prostomium, and the posterior inserted dorsally near hind margin. Second segment with the first pair of elytra and biramous parapodia. Elytra covered by thorn-shaped pointed microtubercles and few scattered papillae, with a row of large pyramid-shaped macrotubercles near posterior margin. Elytra margins with fringing papillae. Notochaetae stouter than neurochaetae, with distinct rows of spines and blunt tips. Neurochaetae with distinct rows of spines only distally, upper bidentate with small secondary tooth distally and lower unidentate (Barnich & Fiege, 2000).

Habitat. May be associated with corals, reported from 200 up to 1000 m depth (Amoureux, 1972; Barnich & Fiege, 2000).

Distribution. Mediterranean Sea: Western Mediterranean, Northeast Atlantic, North Pacific and Arctic (Hartmann-Schröder, 1996).

Harmothoe evei Kirkegaard, 1980

Harmothoe evei Kirkegaard, 1980 p. 82, fig. 1; Barnich & Fiege, 2009, p. 30-31, figs. 4, 14.

Material examined. Atlantic Ocean. Bay of Biscay: **St. Nazaire Canyon**, St M84-5_643, 825 m, 1 spm; St M84-5_644, 825 m, 6 spms (2 cf.); St M84-5_653, 753 m, 1 spm; St M84-5_687, 537 m, 7 spms (1 cf.); St M84-5_688, 667 m, 8 spms; St M84-5_689, 752 m, 4 spms; St M84-5_690, 755 m, 12 spms; **Cap Breton**, St M84-5_633, 221 m, 7 spms; St M84-5_679, 216 m, 1 spm. Azores ZEE: **Atlantis Seamount**, St TTR12_AT422, 375 m, 1 spm. Gorringe Bank: **Gettysburg Seamount**, St NA017_002, 2285 m, 1 spm (cf.); St NA017_046, 385 m, 4 spms. Gulf of Cadiz (CC): **Guadalquivir Ridge**, St TTR11_AT339, 1021-1086 m, 1 spm; **Formosa Ridge**, St TTR12_AT388, 1079 m, 13 spm (1 cf.); **W of Gibraltar**, St TTR14_AT551, 393-445 m, 3 spms (1 cf.); St TTR14_AT552, 428 m, 1 spm (cf.); **Moroccan Margin,** St TTR17-2_AT650, 326 m, 1 spm (cf.); **Pen Duick Escarpment**, St TTR12_AT406, 550 m, 3 spms (1 cf.); St TTR12_AT407, 560 m, 2 spms (1 cf.); St 64PE237_07, 570 m, 1 spm (cf.); St 64PE253_33, 542 m, 1 spm (cf.); **Mound B,** St 64PE268_13B, 493 m, 1 spm; St 64PE268_16, 473 m, 1 spm (cf.); St 64PE268_23A, 496 m, 1 spm (cf.); St 64PE268_27, 471 m, 1 spm (cf.); Gulf of Cadiz (MV): **Al Idrisi MV**, St 64PE253_46B, 227 m, 1 spm (cf.); **Mercator MV**, St JC10_018-Rock2, 432 m, 2 spms; St JC10_018-Rock5, 373 m, 3 spms; St JC10_018-Rock6, 35°18.827'N, 6°37.058'W, 376 m, 1 spm; St 64PE284_12750W, 354 m, 6 spms; St B09-14b_01W, 354 m, 22 spms; **Lazarillo MV**, St 64PE237_21, 498 m, 1 spm (cf.); **TTR MV**, St TTR12_AT416, 695 m, 4 spms (1 cf.); **Meknès MV**, St MSM01-3_321, 732 m, 1 spm (cf.); St B09-14b_03W, 698 m, 1 spm. **Captain Arutyunov MV**, St MSM01-3_180, 1323 m, 1 spm (cf.);
Mediterranean Sea. Alboran Sea (CS): **Crow's Foot Pockmark**, St TTR17-1_MS423, 572 m, 1 spm (cf.); St TTR17-1_MS425, 570 m, 1 spm (cf.); Alboran Sea (CC): **Mellilla Coral Mound Field**, St TTR17-1_MS395, 300 m, 10 spms (cf.).

Brief description. Prostomium rectangular with two distinct anterior peaks, four small eyes, paired antennae very short with a cone-shaped base placed ventrally on the prostomium and a median antenna with a short cone-shaped base. First parapodia with long papillated dorsal and ventral cirri and a chaetal fascicle. Neurochaetae thin and notochaetae thick. Long ventral cirri on second segment, but short and filiform on remaining ones. Some notochaetae are short and strongly curved, the others more longer and straight. Neurochaetae long and slender, some with a small slit at the tip. Elytra covered with small curved thorns (Kirkegaard, 1980).

Habitat. From 217 to 4250 m depth (Kirkegaard, 1980; present study).

Distribution. Northeast Atlantic (from SW of the British Isles to the Gulf of Cadiz, including the Atlantis seamount); West Mediterranean (Alboran Sea) (Kirkegaard, 1980; present study).

Remarks. A total of 137 specimens of *Harmothoe evei* were examined within this study, 32 of which are incomplete or damaged and thus impossible to be fully confirmed. This species was described by Kirkegaard (1980) from abyssal depths (4250 m) southwest of British Isles. The records herein extend

its geographic distribution for the Bay of Biscay, the Atlantis seamount, the Gorringe Bank, the Gulf of Cadiz and the Alboran Sea (W Mediterranean).

***Harmothoe fraserthomsoni* McIntosh, 1897**

Harmothoe fraserthomsoni McIntosh, 1897a p. 401; McIntosh, 1900 p. 337, pl. XXVIII: fig. 7, pl. XXXII: fig. 11, pl. XXIX: fig. 15, pl. XXXIX: fig. 4-6; Campoy, 1982 p. 60; Tebble and Chambers, 1982 p. 36, figs. 11, 35, 36; Chambers and Muir, 1997 p. 102, fig. 25.
Harmothoe Fraser-Thomsoni: Fauvel, 1923 p. 68, fig. 25a-e.
Harmothoe fraser-thomsoni: Bellan, 1964 p. 27.

Material examined. Atlantic Ocean. Bay of Biscay: Cap Breton, St M84-5_633, 221 m, 1 spm.

Brief description. Prostomium bilobed, with prominent cephalic peaks, with a median antenna, a pair of lateral antennae with small ceratophores inserted ventrally, a pair of smooth palps about as long as the median antenna and two pairs of eyes, the anterior pair inserted dorsolaterally on widest part of prostomium, the posterior one inserted dorsally near hind margin of prostomium. Ceratophore of median antenna large in anterior notch. First segment with tentacular cirri. Second segment with the first pair of elytra, biramous parapodia and long ventral buccal cirri. Elytra with smooth margins and surface covered with conical microtubercles and conical macrotubercles scattered on surface and near posterior margin. Parapodia biramous. Notochaetae stouter than neurochaetae, with distinct rows of spines and blunt tips. Neurochaetae with distinct rows of spines only distally, upper ones mostly bidentate with secondary tooth distally and lower ones, unidentate (Barnich & Fiege, 2000).

Habitat. Hard and detritic substrata, associated with corals, from 50 to 250 m depth (Barnich & Fiege, 2000).

Distribution. From the North- to Southeastern Atlantic; Mediterranean (from west to Aegean Sea) (Barnich & Fiege, 2000).

- **Genus *Herdmanella* Darboux, 1899**

Darboux, 1899 [1900] p. 107.

Type species. *Polynoe* (?) *ascidioides* McIntosh, 1885, by monotypy and original designation.

Brief description. Body with 15-17 segments and 8 to 9 pairs of elytra. Prostomium with a pair of well developed lateral antennae and a median antenna. First chaetigers without hooks. Parapodia elongated. Notochaetae and neurochaetae conspicuously long and unidentate (Fauchald, 1977).

cf. *Herdmanella* sp.

Material examined. Atlantic Ocean. Bay of Biscay: St. Nazaire Canyon, St M84-5_688, 667 m, 1 spm; St M84-5_689, 752 m, 1 spm. **Gulf of Cadiz**: Cruise JC_10, RV *James Cook*, Dive 36, 3 spms.

Remarks. Two complete specimens without elytra, from the Bay of Biscay (668-754 m depth), and three incomplete specimens with one elytron only, from the Gulf of Cadiz (2197 m depth), were examined in this study. The specimens are very small, with 18 to 20 segments and less than 10 pairs of elytra. The prostomium has two pairs of faded eyes (difficult to see), a median antenna and a pair of very small lateral antennae, inserted ventraly. The parapodia are biramous with poorly developed notopodia and a few notochaetae. The neuropodia pre- and postchaetal lamellae are well developed and rounded, the ventral cirri are long and inflated and there are small tubercles ventraly, at the base of parapodia, on segments nine, ten and eleven. The notochaetae are strait and only slightly thicker than neurochaetae. The neurochaetae are slightly falcate and unidentate, and have an enlargement halfway to the tip. These characteristics match with *Herdmanella* genus diagnoses present in Fauchald (1977) but further bibliography and a more carefull study is necessary to confirm this determination and also the validity of the genus. The genus *Herdmanella* was erected by Darboux (1899) for the species *Polynoe (?) ascidioides* (Mclntosh, 1885). Later, Ehlers (1908) and Hartman (1967) described two more species, *H. gracilis* and *H. nigra*, for the Atlantic Ocean (a little S to the equator, 1500-2000 m depth) and the Antarctic, respectively. In 1974, Hartmann-Schröder synonymized the genus *Herdmanella* with *Macellicephala* and suggested that the specimens of *H. gracilis* examined by Ehlers (1908) were juveniles of a species related to *Harmothoe*. No types of *H. gracilis* are known to exist. Posteriorly, Pettibone (1976) provided a revision of the genus *Macellicephala* McIntosh, 1885 and considered the genus *Herdmanella* to be doubtfull, based on the indeterminable status of its type species. In the same paper, *H. nigra* was transferred to the genus *Bathyeliasona*, thus leaving the genus *Herdmanella* without any valid species and with a doubtfull status. However, more recently a pelagic species was described for this genus, *H. aequatorialis*, from the Gulf of Guinea (Støp-Bowitz, 1991).

- **Genus *Lepidasthenia* Malmgren, 1867**

Lepidasthenia Malmgren, 1867.

Type species. *Polynoe elegans* Grube, 1840.

Brief description. Prostomium with median antenna and a pair of terminally inserted lateral antennae. Parapodia sub-biramous. Notochaetae present or not with or without notochaetae. Neurochaetae with tips bi- and/or unidentate, and with distinct rows of spines. (Chambers & Muir, 1997; Barnich & Fiege, 2004).

Lepidasthenia cf. *brunnea* Day, 1960

Lepidasthenia brunnea Day, 1960 p. 285, fig. 3 a-d; 1967 p. 92, fig. 1.16n-r; Barnich and Fiege 2003 p. 88, fig. 45 a-h (synonymy); Britayev and Martin, 2005 p. 4090, fig. 6.

Material examined. Atlantic Ocean. Bay of Biscay: Cap Breton, St M84-5_633, 221 m, 1 spm; St M84-5_678, 215 m, 1 spm (cf.); St M84-5_679, 216 m, 1 spm.
Mediterranean. Alboran Sea (CC): Mellilla Coral Mound Field, 15-06-2008, St TTR17-1_MS392, 246 m, 2 spms.

Brief description. Body with up to 100 segments. Dorsum pale brown. Prostomium bilobed and almost twice as broad as long, with two pairs of eyes, the anterior one larger and wider than the posterior one, two lateral antennae and a median one, long and smooth, very similar to each other, and a pair of stout palps. The median antenna is a little longer than the laterals and is 5-6 times the length of prostomium. Elytra smooth, thin and oval. Dorsal cirri rounded and tapering to a slender tip. Ventral cirri short. Notochaetae absent. Superior neurochaetae with long blades and fine hairlike tips, which end in minute knobs. Inferior neurochaetae stouter and with much shorter feathered blades and bidentate tips (Day, 1960, 1967).

Habitat. Free-living on muddy bottoms or within chaetopterid tubes, 85 to 246 m depth (Day, 1960; Britayev & Martin, 2005; present study).

Distribution. Northeast Atlantic, Mediterranean, coast of South Africa (Britayev & Martin, 2005).

Remarks. *Lepidasthenia brunnea* was originaly described from False Bay (S Africa), at 88 m depth, and recorded both as free-living and in association with *Phyllochaetopterus* sp. (Chaetopteridae). More recently, Barnich and Fiege (2003) and Britayev and Martin (2005) found the same species in the Mediterranean, living freely on muddy bottoms and also inside *Phyllochaetopterus* sp. tubes. According

to Britayev and Martin (2005), the Mediterranean specimens were in general accordance with the original description except in having nearly invisible eyes, deeply hidden inside the prostomium tissue. In the present study, five complete specimens (with 75-80 setigers) from the Bay of Biscay (NE Atlantic) and the Alboran Sea (Mediterranean) were examined. These specimens agree with the original description of the species and with the exception regarding the eyes pointed out by Britayev and Martin (2005) for the Mediterranean specimens. A previous molecular analyses to one specimen from the Bay of Biscay and two specimens from the Alboran sea, performed within the framework of a Barcode of Life project ("Deep Sea Polychaetes", unpublished), indicated that the specimens from the two areas form a MOTU (Molecular Operational Taxonomic Unit), thus confirming that they represent a same species (Ravara, pers. com.). The presently known wide geographical range of *L. brunnea* (from NE Atlantic to S Africa) should however be considered with caution and the possibility of representing cryptic species should be investigated. Should the species determination be confirmed as *L. brunnea*, the inferior limit of the bathymetric distribution of this species is herein extended from 129 to 246 m depth.

- **Genus *Leucia* Malmgren, 1867**

Leucia Malmgren, 1867 p. 137.

Type species. *Polynoe nivea* Sars, 1863.

Brief description. Body with up to 50 segments and 16 pairs of scales. Prostomium with distinct cephalic peaks, a median antenna and a pair of ventrally inserted lateral antennae, and two pairs of eyes, the anterior pair at widest part of prostomium, the posterior one located dorsally near hind margin. Notochaetae stout with blunt tips. Neurochaetae more numerous than notochaetae with bidentate and unidentate tips (Chambers & Muir, 1997; Fiege & Barnich, 2009).

***Leucia nivea* (Sars, 1863)**

Polynoe nivea Sars, 1863 p. 291.
Leucia nivea Malmgren, 1867 p. 137; Eliason, 1962 p. 222; Chambers, 1989 p. 145, Chambers and Muir, 1997 p. 118, fig. 33.
Harmothoe echinopustulata Fauvel, 1913 p. 19.

Material examined. **Atlantic Ocean.** Bay of Biscay: **St. Nazaire Canyon**, St M84-5_643, 820 m, 8 spms; St M84-5_687, 537 m, 6 spms; St M84-5_688, 667 m, 1 spm; St M84-5_689, 752 m, 4 spms; St M84-5_690, 755 m, 8 spms; **Cap Breton**, St M84-5_633, 221 m, 3 spms; St M84-5_678, 215 m, 1 spm.

Brief description. Prostomium bilobed, with a peak on each lobe, a median antenna, a pair of lateral antennae, a pair of smooth palps and two pairs of eyes, the anterior one just in front of the line of greatest width, the posterior one in front of the rear margin. First elytron rounded, the following oval to kidney-shape all with smooth margins. First pair of elytra covered with tubercles and the remaining with small tubercles and larger spiny macrotubercles. Notochaetae stout with rows of spines and blunt tips. Neurochaetae with rows of spines and bidentate tips (a few have unidentate tips). Pygidium with a pair of cirri (Chambers & Muir, 1997).

Habitat. Sublittoral, from 8 to 820 m depth, on sandy and shell substrates and associated with the sponge *Desmacidon* (Chambers & Muir, 1997; this study).

Distribution. Northeastern Atlantic Ocean (Norwegian coast, Skagerrak, NE Ireland, Roscoff, West of Azores, Madeira, Morocco) (Chambers & Muir, 1997).

Remarks. Only a few elytra were retrieved with the examined specimens. Its ornamentation, along with the characteristics of the specimens agree well with the species description with exception for the well defined pigmentation pattern found posteriorly on the examined specimens, not mentioned in the description (Chambers & Muir, 1997). This study extends the bathymetric distribution from 400 to 820 m.

***Leucia violacea* (Storm, 1879)**

Laenilla violacea Storm, 1879a p. 32; Storm 1879b p. 124.
Harmothoe violacea Bidenkap, 1894 p. 47; Ditlevsen, 1917 p. 34; Loshamn, 1980 unpublished thesis p. 175, fig. 87.
Evarne normani McIntosh, 1897b p. 168, 169, 178, pl. III, fig. 13.
Leucia violacea: Fiege and Barnich, 2009 p. 157, fig. 4 a–j.

Material examined. Atlantic Ocean. Bay of Biscay: St. Nazaire Canyon, St M84-5_643, 825 m, 1 spm; St M84-5_644, 825 m, 1 spm; St M84-5_653, 753 m, 4 spms; St M84-5_688, 667 m, 2 spms; St M84-5_690, 755 m, 1 spm. **Gulf of Cadiz (CC): Central Coral Mound Province**, St 64PE284_12729, 754 m, 2 spms. **Mediterranean Sea. Alboran Sea (CS): Crow's Foot Pockmark**, St TTR17-1_MS423, 572 m, 1 spm.

Brief description. Prostomium bilobed, with distinct cephalic peaks, with a pair of lateral antennae inserted ventrally, a median antenna, in which the ceratophore is inserted in anterior notch, two pairs of eyes, the anterior one large, dorsolateral, on widest part of prostomium, and the posterior inserted dorsally near hind margin of prostomium, and a pair of palps papillate, tapering. Second segment with biramous parapodia. Anterior elytra with numerous conical microtubercles, and posterior with rather

indistinct, scattered, soft conical to mamilliform macrotubercles, without papillae at margin or on surface. Parapodia biramous. Notochaetae stouter than neurochaetae, with distinct rows of spines and blunt to pointed. Neurochaetae falcigerous, mainly bidentate with stout secondary tooth, some with unidentate tip, with distinct rows of spines distally (Fiege & Barnich, 2009).

Habitat. On hard substrates, often associated with cold water corals like *Lophelia pertusa,* or *Madrepora oculata*, from 30 up to 1262 m depth (Fiege & Barnich, 2009).

Distribution. Northeast Atlantic (from the Norwegian coast to the Gulf of Cadiz); western Mediterranean (Alboran Sea) (Fiege & Barnich, 2009; this study).

Remarks. The specimens studied herein are in accordance to the species *description of* Fiege and *Barnich* (2009), including the pigmentation pattern. The cold water corals *L. pertusa* and *M. oculata* form a symbiotic relation with polychaetes including *L. violacea,* in which basically the polychaetes help the aggregation of the reefs attaching the colonies (Roberts *et al.,* 2006). These records extend the southern geographic limit of the species from the Bay of Biscay to the Gulf of Cadiz and the Alboran Sea (W Mediterranean).

- **Genus *Macellicephala* McIntosh, 1885**

Macellicephala McIntosh, 1885 p. 121 pl. XVI, fig. 1; pl XIIA, figs. 9-11.
Oligolepis Levinsen, 1887.

Type species. *Polynoe (Macellicephala) mirabilis* Mclntosh, 1885, by monotypy.

Brief description. Body with 18 segments. Nine pairs of elytra with prominent elitrophores on segments 2, 4, 5, 7, 9, 11, 13, 15 and 17. Prostomium deeply bilobed with or without frontal filaments, without lateral antennae, median antenna with large ceratophore in the middle of prostomium, palps long, tapered, smooth, without eyes. Pharynx with nine pairs of papillae and two pairs of jaws. First segment distinct dorsally, achaetous. Parapodia sub-biramous, with shorter notopodia and long neuropodia. Notochaetae few to moderate in number, smooth or spinigerous, with blunt tips. Neurochaetae numerous, delicate, transparent and flattened. Dorsal cirri long. Ventral cirri short. Parapodia of segment 18 greatly reduced (Pettibone, 1976).

***Macellicephala* sp.**

Material examined. Atlantic Ocean. Gorringe Bank: Ormonde Seamount, NA017_H1204, 111–2033 m, 3 spms. **Gulf of Cadiz (MV): Mercator MV**, St MSM01-3_241, 353 m, 1 spm.

Remarks. The three specimens examined from the Gorringe bank are incomplete and very damaged and therefore, an accurate determination at species level would not be possible. However, apart from the diagnostic characters of the genus, some other characters can be noted: prostomium frontal filaments short, bulbous at the base and with pointed tips, body colour purple, dorsal tubercles short and digitiform (?), flattened neurochaetae slender with slightly curved unidentate tips and very light spinulation along one side. The only specimen examined from the Gulf of Cadiz is complete and well preserved although laking all the elytra. This specimen is different from the ones from the Gorringe bank by the following characters: anterior part of prostomium lobes drawn ventraly, apparently without frontal filaments, body with rusty areas on dorsum and base of parapodia, dorsum tubercles absent. Due to the lack of bibliography for all the species referred to occur in this area, a further identification was not carried out at this stage.

- **Genus *Polynoe* Savigny in Lamarck, 1818**

Polynoe Fauchald, 1977 p. 64; Chambers & Muir, 1997 p. 136, fig. 42.

Type species. *Polynoe scolopendrina* Savigny in Lamarck, 1818.

Brief description. Body with 15 pairs of elytra on anterior region only, posterior region without elytra. Prostomium with a median antenna and a pair of unususally ventrally inserted lateral antennae, a pair of distinct eyes. Notochaetae stout with blunt tips. Neurochaetae spinigerous with large unidentate and smaller bidentate tips (Chambers & Muir, 1997; Fauchald, 1977).

***Polynoe* sp.**

Material examined. Atlantic Ocean. Gorringe Bank: Ormonde Seamount, NA017_H1204, 111 – 2033 m, 3 spms.

Remarks. Only three specimens and a few loose elytra were examined. Some relevant characteristics are pointed out here. Body with up to 100 segments, posterior part without elytra or its insertion scars. Prostomium has anterior peaks and two pairs of eyes, the anterior one on the line of greatest wide of prostomium. Lateral antennae inserted ventrally to median one. Neurochaetae unidentate, with very light spinulation. Elytra with scattered micropapillae. Further study, preferably with the inclusion of molecular techniques, is needed to accurately identify these specimens to a species level.

- Genus *Robertianella* McIntosh, 1885

Robertianella McIntosh, 1885 p. 122, pl XIV, fig. 4; pl. XX, fig. 5.; pl XIIA, figs. 12, 13 .

Type species. *Robertianella synophthalma* McIntosh, 1885.

Brief description. Body up to 43 segments and 15 pairs of elytra. Prostomium with distinct cephalic peaks with lateral antennae inserted ventrally, a median antenna in anterior notch, one pair of palps, and two pairs of eyes, anterior pair dorsolaterally slightly behind widest part of prostomium, close to posterior pair, posterior pair dorsally near hind margin. Pharynx with nine pairs of border papillae and two pairs of hooked jaws. First pair of elytra rounded and the following oval to kidney-shaped. Surface of elytra covered with few microtubercles and margins without papillae. Second segment biramous with first pair of elytra, and long ventral cirri. Parapodia biramous. Notochaetae stout, with very faint rows of spines and blunt tips. Neurochaetae with very faint rows of spines, only distally, and with bill-shaped tips. Pygidium with one pair of cirri (Barnich & Fiege, 2000).

cf. *Robertianella* sp.

Material examined. Atlantic Ocean. Gulf of Cadiz (CC): Pen Duick Escarpment, St TTR16_AT600, 610 m, 1 spm; St 64PE253_19, 908 m, 1 spm; **Gulf of Cadiz (MV): Gemini MV**, St 64PE253_13, 516 m, 1 spm.

Remarks. Only three specimens lacking elytra were examined. The morphology of the prostomium, parapodia and neurochaeta agree with *Robertianella* genus diagnoses but the number and morphology of the elytra could not be confirmed. Two species of this genus have been described, both for NE Atlantic area, *R. synophthalma* McIntosh, 1885 and *R. platychaeta* Detinova, 1986. Based on the absence of significant differences between the descriptions and figures of these two species and the lack of type material for *R. platychaeta*, Barnich and Fiege (2000) considered this latter species as a junior synonym of *R. synophthalma*. Again, all the characteristics of the specimens examined herein are in accordance to the species description, with exception for the elytra that could not be confirmed. *Robertianella synophthalma* occurs in the NE Atlantic and Mediterranean Sea, from 660 to 2912 m depth, as free-living on muddy substrata and also in association with sponges and crinoids (Barnich & Fiege, 2000).

- **Genus *Subadyte* Pettibone, 1969**

Subadyte Pettibone, 1969a p. 8.

Type species. *Polynoe pellucida* Ehlers, 1864.

Brief description. Body with about 40 segments and 15 (or 16) pairs of elytra. Prostomium bilobed, with lobes rounded anteriorly, with or without distinct cephalic peaks, with a pair of palps, a pair of lateral antennae inserted ventrally and a median antenna. Tentacular segment without chaetae. Parapodia sub-biramous. Notochaetae subequal in width to neurochaetae, with spinigerous pouches and blunt tips, which may be slightly notched. Neurochaetae with basal semilunar pockets and distal spinigerous regions, with tips hooked, bifid. Dorsal cirri with long papillate styles. Ventral cirri short, subulate. Nephridial papillae distinct, small. Elytra delicate, transparent, with large vesicular soft papillae (Pettibone, 1969a).

***Subadyte pellucida* (Ehlers, 1864)**

Polynoe pellucida Ehlers, 1864, p. 105, pl. 2 fig. 10, pl. 3, figs. 5, 7-13, pl. 4, figs. 1-3.
Adyte pellucida Saint-Joseph, 1899, p. 170, pl. 6, figs. 4-5; Tebble and Chambers, 1982 p. 63, figs. 5a, 20c, d, 56b; Chambers and Muir, 1997 p. 80, fig. 14.
Hermadion fragile Claparède, 1868, p. 383, pl. 5, fig. 2; 1870, p. 380, pl. 2, fig. 2.
Hermadion pellucidum Hornell, 1891 p. 237; Alaejos, 1905, p. 31, pl. 4, fig. 7, pl. 5, figs. 1-7.
Scalisetosus communis McIntosh, 1900, p. 372, pl. 26, fig. 6, pl. 27, fig. 12, pl. 30, fig. 9, pl. 33, fig. 7, pl. 34, fig. 1, pl. 40, figs. 17-19. Not *Lysidice communis* delle Chiaje, 1841 (fide Claparède, 1870, p. 380).
Scalisetosus fragilis Day, 1962, p. 631; 1967, p. 59, fig. 1.7, g.k; George, 1974 p.36.
Scalisetosus pellucidus Fauvel, 1914, p. 47; 1923, p. 74, fig. 27, a-f; Monro, 1930, p. 48; Fauvel and Rullier, 1957 p. 35; Rullier, 1964 p. 126; Amoureux, 1972, p. 65; Ibañez 1973 p. 123.
Subadyte pellucida Pettibone, 1969a p. 8, fig. 4; Brito *et al.*, 1991.

Material examined. Atlantic Ocean. <u>**W Iberian Margin**</u>**: Fontanelas**, St TTR17-2_AT691, 1308 m, 1 spm (cf.); <u>**Gulf of Cadiz (CC)**</u>**: Formosa Ridge**, St TTR12_AT388, 1079 m, 1 spm (cf.); **W of Gibraltar**, St TTR14_AT551, 393-445 m, 1 spm; St TTR14_AT552, 428 m, 1 spm; **Pen Duick Escarpment**, St TTR12_AT406, 550 m, 1 spm; St TTR12_AT407, 560 m, 1 spm; St TTR16_AT600, 610 m, 1 spm; St 64PE268_41, 461 m, 1 spm; **Mound B,** St 64PE268_16, 473 m, 1 spm; **Central Carbonate Mound Province,** St 64PE284_12729, 754m, 1 spm; **Meknès Carbonate Mound Province,** St 64PE284_12739, 736 m, 1 spm; <u>**Gulf of Cadiz (MV):**</u> **Mercator MV**, St TTR15_AT575, 355 m, 1 spm; St B09-14b_01W, 354 m, 9 spms; **TTR MV**, St TTR12_AT416, 695 m, 1 spm; **Meknès MV**, , St B09-14b_03W, 689 m, 5 spms; **Darwin MV**, St TTR16_AT608, 1115 m, 2 spms (cf.); St TTR17-2_AT664, 1128m, 1 spm; St 64PE284_12750W, 354 m, 4 spms; St B09-14b_02W, 1100 m, 4 spms (cf.).
Mediterranean Sea. <u>**Alboran Sea (CC):**</u> **Mellilla Coral Mound Field,** St TTR17-1_MS395, 300 m, 5 spms.

Brief description. Prostomium bilobed without cephalic peaks, with a median antenna, a pair of lateral antennae, a pair of palps and two pairs of eyes. Scales overlap almost covering the body, oval to

rounded, transparent, with small tubercles on surfaces and smooth margins. Notochaetae as stout as, or slightly stouter than neurochaetae, flat with rows of proeminent spines and blunt tips. Neurochaetae with a cusp at the base of the rows of spines, and a bidentate tip (Chambers & Muir, 1997).

Habitat. Littoral and sub-littoral, on almost all kinds of sediment or among algae, often associated with echinoderms, crinoids and corals (Pettibone, 1969a; Brito *et al.*, 1991; Chambers & Muir, 1997).

Distribution. East Atlantic (from North Sea to S Africa), Mediterranean (Adriatic Sea), Indian Ocean (Bay of Bengal), Pacific (New South Wales) (Pettibone, 1969a; Chambers & Muir, 1997).

Remarks. A total of 42 specimens were examined within this study. The majority of the specimens were collected at depths from 354 to 754 m, and were in accordance with the species description. Nine other specimens occurred at deeper places, mainly on Darwin mud volcano, from 1079 to 1308 m depth. These specimens were much smaller or incomplete, without elytra or even damaged. The cusp of neurochaetae was clearly present but all other characteristics were difficult to confirm. Therefore, and considering the different depth range, the identification of these specimens should be considered with caution and further investigated using molecular tools.

Family Sigalionidae

Sigalionidae was first treated as a family name by Kinberg (1856) (note that the name was incorrectly referred to Malmgren, 1867 in Fauchald and Rouse 1997). The first described species were *Sigalion mathildae* Audouin & Milne Edwards in Cuvier, 1830 (*Sigalion* type species), and *Sigalion arenosum* and *S. squamosum* delle Chiaje, 1830 (Muir, 1989). *Sigalion arenosum* was later transferred to the genus *Pelogenia* Schmarda, 1861 and included in the subfamily Pelogeniinae Chamberlin, 1919 together with the genera *Claparedepelogenia, Daysipsammolyce, Hartmanipsammolyce, Heteropelogenia, Neopsammolyce,* and *Pottsipelogenia*, all erected by Pettibone (1997b), and *Psammolyce* Kinberg, 1856 (Pettibone, 1997b). All other genera of the family are included in the nominal subfamily Sigalioninae. Sigalionidae comprises at present about 30 genera and more than 200 nominal species, including the genera *Pholoides* Pruvot, 1895, *Pisione* Grube, 1857, *Pisionella* Hartman, 1939 and *Pisionidens* Aiyar & Alikunhi, 1943, previsouly referred to the families Pholoididae and Pisionidae, respectively. Important studies on this family were done by Ehlers (1864) and Darboux (1899), and more recently by Pettibone (1969b, 1970a, b, c, 1971a, b, 1992b, 1997b) and Mackie and Chambers (1990). Recent

studies for the northern Europe include Chambers (1985), Hartmann-Schröder (1996) and Chambers and Muir (1997), and for deep-sea and cold-water corals, Kongsrud *et al.* (2013), Barnich *et al.* (2013) and Miranda and Brasil (2014). In 2002, also Aungtonya made an important overview of the genera, and in 2003, the same author evaluated its most important characters. An important revision of the family, from the Arabian Peninsula, was made by Wehe in 2007.

Sigalionids occur in all seas, from the intertidal down to several thousand meters of depth, and are usually burrowers on sand and mud (Rouse & Pleijel, 2001). Fauchald and Jumars (1979) considered them as predators of small invertebrates. Their circulatory system is closed. Although the number of studies about their reproduction is reduced, as far as it is known they are dioecious (Rouse & Pleijel, 2001).

Morphologically sigalionids are characterized by a long and slender body, of medium to large size, with up to several hundreds of segments. Many lack distinct pigmentation and are white to yellowish, but some may have red pigments on appendages and segments, and dark pigmentation on elytra (Figure 18).

Figure 18. Sigalionid specimen. (by Moorea Biocode 2010; source: http://calphotos.berkeley.edu/cgi/img _query?enlarge=4444+4444+0211+1037).

The prostomium is rounded to rectangular, usually with two pairs of small eyes, a pair of palps, a pair of small lateral antennae and sometimes a median antenna, with or without auricles. The pharynx is muscular and eversible with terminal papillae and two pairs of dorso-ventrally oriented jaws. Elytra are present on second, fourth, fifth and seven, then alternate up to segment twenty-five or twenty-seven; their surfaces may be smooth or covered by microtubercles and their margins may be smooth or papillated. The first segment is fused to the prostomium and has parapodia and two pairs of tentacular cirri. Biramous parapodia begin in the second segment and have dorsal and ventral cirri. Notoaciculae and neuroaciculae are present along with compound spinigerous or falcigerous chaetae, which may be articulated. Branchiae may be present on some taxa on median and posterior segments. Ctenidia are

located on the notopodia, between the elytrophores and the notochaetae. Pygidium with a single pair of cirri (Figure 19) (Hutchings, 2000c; Rouse & Pleijel, 2001).

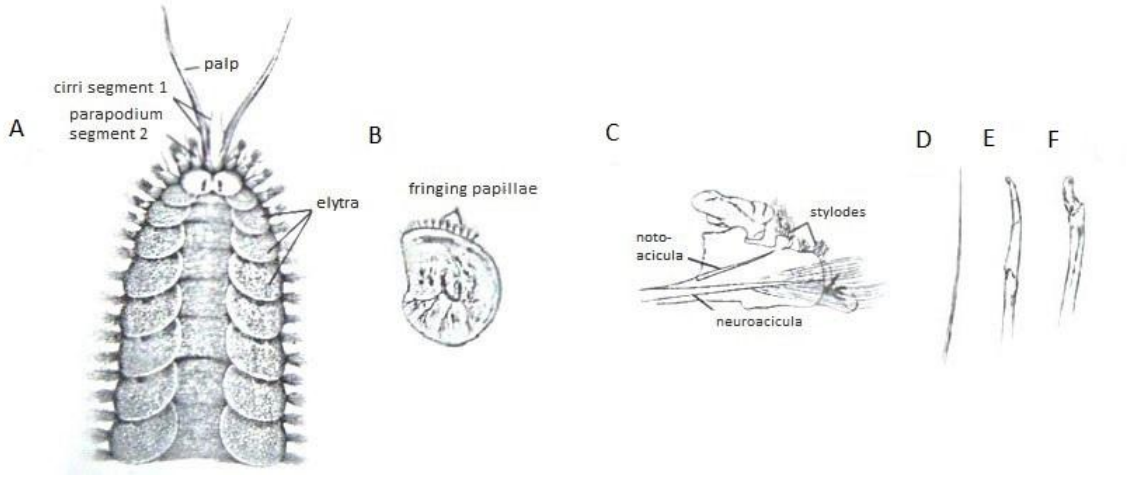

Figure 19. Representative scheme of Sigalinoid morphology. A. Anterior end of *Euthalenessa festiva*, dorsal view. B. Elytron. C. Parapodia from second segment. D. Capillary chaetae. E. Compound spinigerous chaetae. F. Compound falcigerous chaetae (after Hutchings, 2000c).

- **Genus *Fimbriosthenelais* Pettibone, 1971**

Fimbriosthenelais Pettibone, 1971b p. 25.

Type species. *Sthenelais longipinnis* Grube, 1870.

Brief description. Prostomium rounded with four eyes, a median antenna with stout cylindrical ceratophore and auricles, lateral antennae and a pair of palps. Pharynx with eleven or thirteen pairs of papillae and two pairs of jaws. Elytra large with microtubercles or papillae, and lateral fringed papillae. First segment with a pair of tentacular cirri, single aciculum and two bundles of capillary chaetae. Third segment without dorsal cirri. Branchiae cirriform. Notochaetae directed posterior-dorsally, finely spinulated and tapering to capillary tips. Neurochaetae of segments two and three compound falcigerous, with articulate blades and bifid tips; following ones with simple spinigerous and compound falcigerous, with articulate blades and bifid tips. Ventral cirri subulate with outer basal knobs (Pettibone, 1971b; Fauchald, 1977).

***Fimbriosthenelais zetlandica* (McIntosh, 1876)**

Sthenelais? zetlandica Mclntosh, 1876a p. 390, pl. LXX, figs. 15-17.
Sthenelais atlantica Mclntosh, 1876b p. 405, pl. LXII, figs. 16, 17; 1900 p. 415, pl. XXIX, fig. 2, pl. XXXIV, fig. 8, pl. XLI, figs., 27, 28.
Sthenelais sarsi Mclntosh, 1897b p. 174, pl. III, figs. 1-5.

Sthenelais zetlandica Mclntosh, 1900 p. 414, pl. XXX: fig. 14, pl. XXXIV, fig. 7, pl. XLI, figs. 24-26; Southern, 1914 p. 55, pl. VI, fig. 13a, b; Eliason, 1962 p. 228.
Sthenelais papillosa Day, 1960 p. 289, fig. 3e-j; 1967 p. 108, fig. 1.20a-e.
Sthenelais vachoni Rullier, 1964 p. 139, fig. 6a-l.
Fimbriosthenelais zetlandica Pettibone, 1971b p. 32, figs. 21, 22.

Material examined. Atlantic Ocean. Bay of Biscay: St. Nazaire Canyon, St M84-5_643, 825 m, 3 spms; St M84-5_644, 825 m, 1 spm (cf.); St M84-5_688, 667 m, 1 spm (cf.). **Gulf of Cadiz (CC): Vernadsky Ridge**, St 64PE284_12759, 524 m, 1 spm; **Pen Duick Escarpment,** St TTR16_AT600, 610 m, 1 spm; St 64PE253_23, 557 m, 1 spm; **Gulf of Cadiz (MV): Meknès MV**, TTR14_AT541, 703 m, 1 spm; St MSM01-3_321, 732 m, 1 spm; St B09-14b_03W, 698 m, 1 spm; **Ginsburg MV**, St TTR16_AT607, 983 m, 1 spm; **Jesus Baraza MV**, St TTR12_AT391, 1105 m, 1 spm; **Darwin MV**, St TTR16_AT608, 1115 m, 1 spm; St TTR17-2_AT664, 1128 m, 1 spm.

Brief description. Prostomium with a median antenna with small auricles, short lateral antennae, four large eyes in the middle and a pair of palps. Elytra delicate, transparent, suborbicular, subrectangular to subreniform, covered with flat to subconical microtubercles, lateral and posterior margins with short clavate to globular micropapillae. Dorsal cirri slightly longer than median antenna. Ventral cirri about half as long as dorsal cirri. Dorsal ctenidia elongate-oval. Parapodial acicular lobes with papillate stylodes. All neurochateae compound falcigerous with bidentate tips. Branchiae cirriform (Pettibone, 1971b; Chambers, 1985; Chambers & Muir, 1997).

Habitat. From 33 (Pettibone, 1971b; Chambers, 1985; Chambers & Muir, 1997) to 1128 m depth (this study).

Distribution. Northeast Atlantic (from off Norway to Cape Verde Islands), Southeast Atlantic (False Bay) (Pettibone, 1971b; Chambers, 1985; Chambers & Muir, 1997).

Remarks. Pettibone (1971b) erected the genus *Fimbriosthenelais* to accommodate species previously referred to the genus *Sthenelais* (including *S. zetlandica*) that have papillate parapodial stylodes. Chambers (1985) considered that this unique difference does not warrants generic separation and thus re-establish the species as belonging to the genus *Sthenelais*. This classification was maintained by Chambers & Muir (1997) and Jirkov (2001). Recently, Aungtonya (2002) in a study of the Sigalionidae from Thailand recognized the genus *Fimbriosthenelais* as valid. In the present study, this genus is maintained. However, further studies should be addressed to this issue, preferably with the inclusion of molecular techniques, in order to clearly establish the relation between these two taxa. All the 15 specimens examined herein are incomplete; the majority is of small size and/or lack elytra.

However, the diagnostic characteristics of the species were overall verified, namely, the morphology of the prostomium and its appendages, the papillate stylodes, the neurochaetae and the elytra (when present). The bathymetric distribution of the species is here extended from 558 m (Pettibone, 1971b; Chambers, 1985; Chambers & Muir, 1997) to 1128 m depth.

- **Genus *Labioleanira* Pettibone, 1992**

Labioleanira Pettibone, 1992b p. 619.

Type species. *Leanira yhleni* Malmgren, 1867 p. 140.

Brief description. Prostomium oval with two pairs of eyes, a pair of long palps and three antennae, the lateral ones small and the median one with stout ceratophore and lateral auricles. Pharynx with eleven pairs of border papillae and two pairs of jaws. Branchiae cirriform. Parapodia biramous. Notochateae capillary. Neurochaetae compound spinigerous with short blades tapering to fine tips. Ventral cirri short tapered. Pygidium with a pair of long cirri (Pettibone, 1992b).

***Labioleanira yhleni* (Malmgren, 1867)**

Leanira yhleni Malmgren, 1867 p. 140; Tebble, 1955 p. 77; Intes and Le Loeuff, 1975 p. 289. (not *Leanira yhleni* Rullier, 1965 p. 171 = *Labiosthenolepis sibogae* (Horst, 1917)).
Sthenolepis yhleni Hartman, 1965a p. 14; Campoy, 1982 p. 98, pl. VI, figs. h, i; Kirkegaard, 1983b p. 200, fig. 3a-d.
Labioleanira yhleni Pettibone, 1992b p. 612, figs. 5, 6.

Material examined. Mediterranean Sea. Alboran Sea (CC): Mellilla Coral Mound Field, St TTR17-1_MS393, 245 m, 1 incomplete spm.

Brief description. Prostomium oval, wider than long. Ceratophore of median antenna large with proeminent auricles. Lateral antennae short. Pair of eyes lateral to base of ceratophore. Palps very long. Elytra thin, transparent, without tubercles or papillae. Notochaetae long and capillary. Neurochaetae compound spinigerous with blades rather long, canaliculated (Pettibone, 1992b).

Habitat. From 1 to 1900 m depth (Pettibone, 1992b).

Distribution. Northeast Atlantic (France, Spain), Mediterranean Sea, South Atlantic (West Africa) (Pettibone, 1992b).

- **Genus *Leanira* Kinberg, 1856**

Leanira quatrefagesi Kinberg, 1856.

Type species. *Leanira quatrefagesi* Kinberg, 1856.

Brief description. Prostomium oval, partially fused to tentacular parapodia. Ceratophore of median antenna without auricles or ctenidia. Lateral antennae short, fused to tentacular parapodia. Pharynx with eleven pairs of papillae and jaws. Elytra smooth, lacking tubercles and papillae. Dorsal cirri and dorsal tubercles lacking on segment 3. Cirriform branchiae and elongate plate-like ctenidia. Notochaetae spinigerous capillaries. Neurochaetae compound spinigerous with relatively short, canaliculated appendages. (Pettibone, 1970a; Fauchald, 1977).

***Leanira hystricis* Ehlers, 1874**

Leanira hystricis Ehlers, 1874, p. 292; 1875, p. 35, pl. II, figs. 5-11; 1908, p. 55; McIntosh, 1876b p. 408, pl. LXXIII, figs. 6-8; 1885 p. 155; 1900 p. 434, pl. XXVIII, fig. 17, pl. XXXI, figs. 12, 13, pl. XLII, figs. 20-22; Fauvel, 1914 p. 84; 1923 p. 118, fig. 43h-m; Ditlevsen, 1917 p. 48; Pettibone, 1970a p. 8, fig. 4.
Leanira laevis McIntosh, 1874a p. 268 (nomen nudum).

Material examined. Atlantic Ocean. Gulf of Cadiz (MV): Bonjardim MV, St TTR15_AT597, 3061 m, 1 spm; **Porto MV**, St TTR16_AT622, 3902 m, 1 spm; St MSM01-3_161, 3864 m, 1 spm.

Brief description. Prostomium oval with long palps, short median antenna attached to an indistinct ridge on the anterior third of the prostomium and similar lateral antennae attached to the inner dorsal sides of the tentacular parapodia. Eyes absent. Dorsal tentacular cirri much longer than ventral ones. Dorsal cirri and dorsal tubercles are lacking on segment 3. Elytra thin, small, smooth, rounded to elongate-oval, present on all segments from segment 25. Notochaetee slender, coarsely to finely spinose and tapering to capillary tips. Neurochaetae all compound spinigerous, with canaliculate blades tapering to fine tips. Neurochaetae of lower part more slender than the others. Ventral cirri slender, tapered (Pettibone, 1970a).

Habitat. From 957 to 3902 m depth (Pettibone, 1970a; this study).

Distribution. North Atlantic (S Iceland, off Great Britain, off Azores, Gulf of Cadiz) (Pettibone, 1970a; this study).

Remarks. The three specimens examined herein are incomplete and lack elytra. However the general morphological characteristics, in particular the spinigerous neurochaetae and the absence of eyes and

auricles on prostomium, point out to the species *Leanira hystricis*. This is a deep-sea species occurring from south Iceland to Azores, and here referred also to the Gulf of Cadiz. The bathymetric distribution is also extended from 2640 m (Pettibone, 1970a) to 3902 m depth.

- **Genus *Pholoides* Pruvot, 1895**

Pholoides Pruvot, 1895 p. 655.
Peisidice Johnson, 1897 p. 184.
Pareupholoe Hartmann-Schröder, 1962 p. 110.
Parapholoe Hartmann-Schröder, 1965 p. 92.

Type species. *Pholoe dorsipapillata* Marenzeller, 1893 by monotypy.

Brief description. Prostomium fused with first segment, subrectangular, with two pairs of eyes and a median antenna with ceratophore on anterior border, without lateral antennae. Pharynx with nine dorsal and ventral papillae and two pairs of jaws. Elytra thick, subrectangular, with concentric rings and many long fringing papillae. Parapodia biramous. Notochaetae simple, slender, capillary, finely spinose. Neurochaetae stouter than notochaetae, compound, with smooth or spinose shafts and short, falcate, smooth or faintly spinose blades. Ventral cirri short, papillate. Pygidium with a pair of cirri (Pettibone, 1992a).

***Pholoides dorsipapillatus* (Marenzeller, 1893)**

Pholoe dorsipapillata Marenzeller, 1893 p. 30, pl. I, fig.3a-d; Fauvel, 1914 p. 82; 1923 p. 119, fig. 44n-q; Day, 1963 p. 389; 1967 p. 100, fig. 1.18g-i; Rullier, 1964 p. 137; Amoureux, 1972 p. 71; Campoy, 1982 p. 92.
Pholoides dorsipapillatus Pettibone, 1992a p. 16, figs. 8, 9.
Pholoides dorsipapillata Pruvot, 1895 p. 655.
Psammolyce fijensis McIntosh, 1885, p. 146.
Peisidice bermudensis Hartman & Fauchald, 1971 p. 30, pl. II, figs. a-e; Hartmann-Schröder, 1977 p. 81, figs. 10-16; 1979 p. 71, figs. 15, 16; 1981 p. 26.
Peisidice dorsipapillata Katzmann, 1973 p. 111; Hartman, 1974 p. 210; Laubier, 1975 p. 678.
Pholoides bermudensis Uebelacker, 1984 p. 23.1, figs. 23.1, 23.2; San Martín *et al.*, 1986 p. 9, fig. 6A-C.
Peisidice aspera Rosenfeldt, 1989 p. 217 [not Johnson, 1897].

Material examined. Atlantic Ocean. Bay of Biscay: St. Nazaire Canyon, St M84-5_643, 825 m, 1 spm; St M84-5_644, 825 m, 1 spm; St M84-5_649, 1105 m, 3 spms; St M84-5_651, 982 m, 3 spm; St M84-5_653, 753 m, 2 spms; St M84-5_688, 667 m, 4 spms; St M84-5_689, 752 m, 2 spms; St M84-5_690, 755 m, 1 spm. **W Iberian Margin: Fontanelas**, St TTR17-2_AT689, 1194 m, 4 spms; St TTR17-2_AT690, 1340 m, 1 spm; St TTR17-2_AT691, 1308 m, 3 spms; **Azores EEZ: Atlantis Seamount,** St TTR12_AT421, 555 m, 1 spm. **Madeira EEZ: Nameless Seamount**, St TTR11_AT353, 1853 m, 1 spm. **Gorringe Bank: Gettysburg**

Seamount, 10-10-2011, St NA017_002, 2285 m, 1 spm; St NA017_045, 614 m, 1 spm; **Ormonde Seamount,** St NA017_H1204, 111–2033 m, 2 spms. Gulf of Cadiz (CC): **Cadiz Channel**, St TTR15_AT599, 1275-1418 m, 3 spms; **Guadalquivir Ridge**, St TTR11_AT339, 1086 m, 44 spm; **Formosa Ridge**, St TTR12_AT388, 1079 m, 113 spms; **Ibérico Mound**, St TTR11_AT335, 905-1037 m, 26 spm; **W of Gibraltar**, St TTR14_AT550, 368-392 m, 5 spms; St TTR14_AT551, 393-445 m, 4 spms; St TTR14_AT552, 428 m, 2 spms; **Vernadsky Ridge**, St TTR15_AT574, 512 m, 4 spms; St 64PE284_12759, 524 m, 3 spms. **Pen Duick Escarpment**, St TTR12_AT406, 550 m, 3 spms; St TTR12_AT407, 35°17.695'N, 6°47.082'W, 560 m, 2 spms; St 64PE237_16A, 660 m, 1 spm; St TTR16_AT600, 610 m, 3 spms; St 64PE253_23, 557 m, 1 spm; St 64PE253_24, 571 m, 1 spm; St 64PE253_25, 648 m, 1 spm; St 64PE253_40A, 560 m, 1 spm; St 64PE253_53, 651 m, 1 spm; St 64PE253_54, 634 m, 1 spm; St 64PE268_20, 765 m, 1 spm; St 64PE268_40, 473 m, 2 spms; St 64PE268_46, ~720 m, 6 spms; **Mound B**, St 64PE268_11, 493 m, 1 spm; St 64PE268_11A, 489 m, 1 spm; St 64PE268_12, 500 m, 1 spm; St 64PE268_13A, 475 m, 1 spm; St 64PE268_13B, 493 m, 1 spm; St 64PE268_16, 473 m, 3 spms; St 64PE268_27, 471 m, 1 spm; **SE of Yuma Carbonate Mound Province**, St 64PE284_12721, 868 m, 4 spms; St 64PE284_12722, 907 m, 5 spms; **Meknès Carbonate Mound Province**, St 64PE284_12739, 736 m, 4 spms; Gulf of Cadiz (MV): **Mercator MV**, St MSM01-3_241, 353 m, 1 spm; St JC10_018-Rock2, 432 m, 1 spm; **Fiuza MV**, St TTR14_AT566, 414 m, 3 spms; **Gemini MV**, St 64PE253_08, 444 m, 1 spm; St 64PE253_09, 451 m, 3 spms; St 64PE253_10, 432 m, 4 spms; St 64PE268_19, 430 m, 6 spms; **Kidd MV**, St TTR14_AT528, 489 m, 17 spms; St TTR14_AT560, 498 m, 6 spms; St TTR14_AT561, 526 m, 5 spms; **Lazarillo MV**, 64PE237_21, 498 m, 9 spms; St 64PE253_38B, 497 m, 5 spms; **TTR MV**, St TTR12_AT413, 695 m, 1 spm; St TTR12_AT416, 695 m, 6 spms; **Meknès MV**, St TTR14_AT541, 703 m, 2 spms; St MSM01-3_321, 732 m, 1 spm; St 64PE284_12748, 722 m, 1 spm; **Yuma MV**, St TTR14_AT524, 960 m, 3 spms; St TTR16_AT604, 1030 m, 1 spm; **Jesus Baraza MV**, St TTR12_AT391, 1105 m, 2 spms; **Darwin MV**, St TTR16_AT608, 1115 m, 2 spms; St JC10_028-Rock5, 1119 m, 1 spm; **Captain Arutyunov MV**, St TTR12_AT399, 1339 m, 1 spm; St MSM01-3_180, 1323 m, 2 spms; **Carlos Ribeiro MV**, St MSM01-3_184, 2233 m, 1 spm. **Mediterranean Sea.** Alboran Sea (CC): **Mellilla Coral Mound Field,** St TTR17-1_MS395, 300 m, 1 spm. East Mediterranean: **Cretan Sea**, St RED10_05, 1018 m, 4 spms; St RED11_04, 1620 m, 4 spms; St RED11_05, 1018 m, 30 spms; St RED11_08, 1772 m, 4 spms; St RED11_09, 1194 m, 1 spm.

Brief description. Prostomium wider than long fused with first segment, with two pairs of eyes, a median antenna with ceratophore on anterior border of prostomium and a pair of stout palps. Second segment with long ventral buccal cirri. Notochaetae numerous, long, spinose capillaries. Neurochaetae stouter than notochaetae, compound with smooth or subdistaly spinose shafts and short, smooth or slightly spinigerous blades (Pettibone, 1992a).

Habitat. Coarse sand, and mud, pumice stone and muddy substrata, from 37 to 2285 m depth (Pettibone, 1992a; this study).

Distribution. Atlantic ocean (on west part, from Bermuda, Cuba, Gulf of Mexico to Azores; on east part, from the Bay of Biscay to off Madeira island; North and South Africa), Mediterranean Sea, Adriatic Sea, Red Sea (Pettibone, 1992a; this study).

Remarks. A total of 409 specimens were examined. The geographic and bathymetric distribution of this species is here extended for the northeast Atlantic (from the Bay of Biscay to off Madeira Island) at depths until 2285 m (instead of 1153 m, Pettibone, 1992a).

- **Genus *Sthenelais* Kinberg, 1856**

Sthenelais Kinberg, 1856; Pettibone, 1971b p. 2.

Type species. *Sthenelais helenae* Kinberg, 1856 designated by Hartman (1949:34).

Brief description. Prostomium rounded with a median antenna with stout cylindrical ceratophore and lateral auricles, two pairs of eyes, a pair of palps and lateral antennae that extends to tentacular parapodia. Tentacular parapodia extending anteroventrally to prostomium, with a pair of tentacular cirri, single aciculum and two bundles of capillary chaetae and ciliated dorsal ctenidium. Neurochaetae of second and third segments compound falcigerous with articulated blades and bifid tips. Branchiae cirriform and ciliated on external borders of all elytrophores and dorsal tubercles except few anterior ones. Ctenidia cup-shaped, ciliated, three per parapodium, beginning on second segment. Notochaetae directed postero-dorsally, finely spinulated and ending in capillary tips. Neurochaetae simple spinulated and compound falcigerous with some blades articulated and tips bifid. Pharynx with eleven pairs of papillae and two pairs of jaws (Pettibone, 1971b; Chambers & Muir, 1997).

***Sthenelais jeffreysi* McIntosh, 1876**

Sthenelais jeffreysi McIntosh, 1876b p. 406; McIntosh, 1900 p. 422; Eliason, 1962 p. 224.
? *Sthenelais heterochaeta* McIntosh, 1897b (subjective synonym) p.179, pl. II, fig. 6.

Material examined. Atlantic Ocean. Bay of Biscay: St. Nazaire Canyon, St M84-5_643, 825 m, 1 spm. **Gulf of Cadiz (CC): Pen Duick Escarpment**, St TTR12_AT407, 560 m, 1 spm; St TTR16_AT600, 610 m, 1 spm; **Gulf of Cadiz (MV): Meknès MV**, St MSM01-3_321, 732 m, 1 spm (cf.).

Brief description. Prostomium rounded with a median antenna in a large ceratophore, four eyes, a pair of palps and large nuchal organs on posterior margin. Scales smooth furnished with approximately ten long papillae on exterior border, though in low quantity. Notochaetae slender, most delicately serrated, with fine rows of spines. Neurochaetae spinulated at the superior part of neuropodia, and with tapering filiform tips, short bifid tips and long delicate bifid tips, at the inferior part. Ventral cirri nearly as long as the tip of the parapodia (McIntosh, 1876b).

Habitat. From 271 to 820 m depth (McIntosh, 1876b; Eliason, 1962; this study).

Distribution. Atlantic Ocean (Skagerrak, off W Ireland, Bay of Biscay, Gulf of Cadiz) (McIntosh, 1876b; Eliason, 1962; this study).

Remarks. The four specimens examined herein verify the diagnostic characteristics of *Sthenelais jeffreysi*. This species can be distinguished from *S. boa* and *S. limicola*, the other species referred to occur in this region, mainly by the larger fringing papillae of the elytra (shorter on *S. boa* and absent or only a few bifurcate papillae on *S. limicola*) and the presence of spinigerous neurochaetae (absent on the other two species) (McIntosh, 1876b).
Sthenelais boa occurs mainly at coastal zones in shallower waters, while *S. limicola* is referred to occur offshore until continental slope depths. The geographic and bathymetric distribution of *S. jeffreysi*, previously known only from Skagerrak and west Ireland until ca. 300 m depth, is here extended to the Bay of Biscay and the Gulf of Cadiz at depths from 560 to 820 m.

Suborder Glyceriformia

Due to their great morphological resemblance and phylogenetic sister-group relationship, the families Glyceridae and Goniadidae have been frequently regarded and treated together as 'Glyceriformia'. The first species, *Glycera alba*, was described by O. F. Müller (1776) as *Nereis*, while the genus *Glycera* was described by Savigny (in Lamarck, 1818) for *Glycera unicornis*. *Goniada*, in turn, was described by Audouin and Milne-Edwards (1833), for the species *Goniada emerita*. These authors included the genus *Goniada*, together with *Glycera* and *Nephtys* in the group "Néréidiens non tentaculés". The family Glyceridae was later established by Grube (1850) to include the genera *Glycera* and *Goniada*, and in 1866 these two genera were separated with the erection of the family Goniadidae by Kinberg. In 1950, Hartman clarified the differences between these two families. Nevertheless, this separation has been a matter of controversy with some authors considering them as subfamilies (Glycerinae and Goniadinae) within the suborder Glyceriformia (e.g. Day, 1967; Rullier, 1972). Recently, Böggemann (2002) presented a phylogenetic analysis based on morphological characters revealing these two families as separate taxa defined by the autopomorphies in the structure of the jaws, the proboscideal papillae, and the ciliar pattern on the prostomium. Major taxonomic works for both families include Arwidsson (1897, 1898), Voit (1911), Støp-Bowitz (1941), Hartman (1950) and Böggemann (2002, 2005).

Recent studies for north Atlantic and Mediterranean regions include O'Connor (1985, 1987) and Hartmann-Schröder (1996).

Both Glyceridae and Goniadidae are widely distributed organisms present from the intertidal to abyssal depths and occur most commonly as burrowers in muddy and sandy bottoms. They may reach considerable sizes, from 1 cm up to 1 m long, with several hundreds of segments (Rouse & Pleijel, 2001; Böggeman, 2002, 2005). The majority of the taxa are carnivores, capturing their prey with jaws located at the end of the eversible pharynx (Fauchald & Jumars, 1979).

Family Glyceridae Grube, 1850

At present, the family Glyceridae includes three genera (*Glycera* Savigny in Lamarck, 1818, *Glycerella* Arwidsson, 1899 and *Hemipoda* Kinberg, 1866) and up to 50 valid species (Böggemann, 2002, Böggemann *et al.*, 2012; Imajima, 2003, 2009; Rizzo *et al.* 2007; Magalhães & Rizzo, 2012). Although, according to Ruppert and Smith (1988), there is no circulatory system in Glyceridae, glycerids are often known as "bloodworms" due to the bright red color that can be seen through their transparent body wall (Figure 20).

Figure 20. *Glycer*a sp. (Source: website http://en.academic.ru/dic.nsf/enwiki/247545)

Some species may be white, depending on the colour of their body fluids (Rouse & Pleijel, 2001). Glycerid specimens have an elongated, conical prostomium with many annulations of which the basal one bears a pair of nuchal organs. A pair of very small palps and antennae is located at the tip of the prostomium. Eyes are absent in adult organisms. They have a long, muscular, eversible pharynx covered with papillae and ending in a ring with four similar jaws, each consisting of a proper hook-

shaped jaw and an aileron (Figure 21). The majority of the Glyceridae (with exception to *Hemipodia*) have biramous parapodia with noto- and neuroaciculae, finely spinulose notochaetae and composite spinigers neurochaetae (*Glycerella magellanica* (McIntosh, 1885) also have composite falcigers). The noto- and neuropodial rami are very close together and have pre- and postchaetal lobes developed to different degrees and shapes, and dorsal and ventral cirri. Branchiae may be present, usually on the dorsal part of the parapodia, and may be simple or branching, retractable or non-retractable. Segments are often divided into two or three rings. The pygidium carries a pair of slender, elongated cirri (Rouse & Pleijel, 2001; Böggemann, 2002).

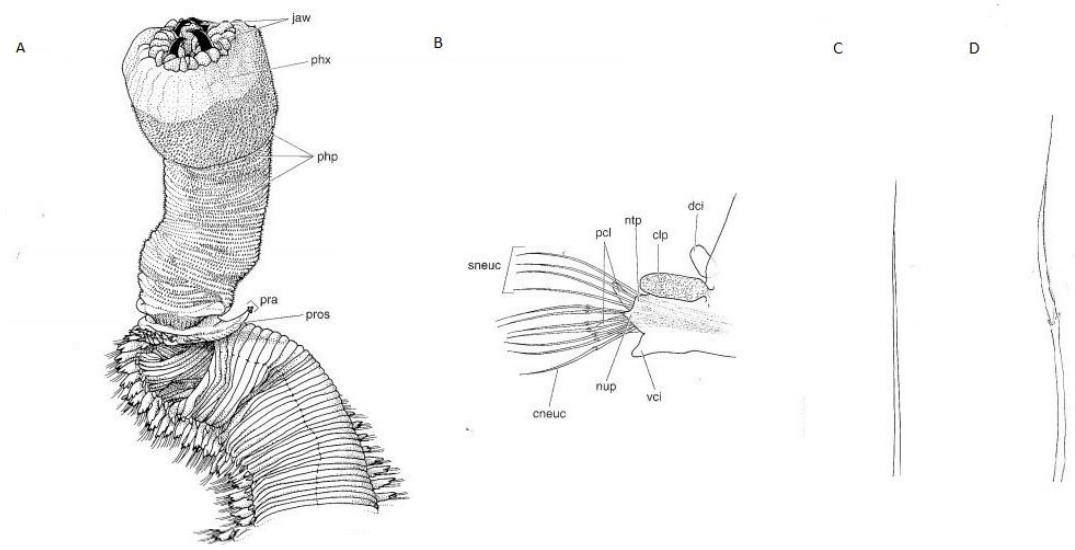

Figure 21. Representative scheme of Glycerid morphology. A. Anterior end of *Glycera* species with pharynx everted. B. Parapodium from a medium segment of of *Glycera* species, dorsal view. C. Simple Notochaetae. D. Compound neurochaetae. Legend: clp - coeloemic loop; cneuc - compound neurochaetae; dci - dorsal cirri; jaw - jaws; ntp - notopodium; nup - neuropodium; pcl - postchaetal lobes; php - pharyngeal papillae; phx - pharynx everted; pra – prostomial appendages; pros - prostomium; sneuc - simple neurochaetae (after Wilson, 2000a).

The glycerids have a worldwide distribution, mostly on sandy substrates, from the intertidal to the deep sea (Fiege & Böggemann, 1997). They are generally carnivorous and venomous, capturing prey with their jaws and killing them by the injection of venom (Ockelmann & Vahl, 1970; Fauchald & Jumars, 1979; Manaranche *et al.,* 1980). In terms of reproduction glycerids are monotelic, having separate sexes (Rouse & Pleijel, 2001).

- **Genus *Glycera* Savigny in Lamarck, 1818**

Rhynchobolus Bobretzky, 1870.
Hamiglycera Ehlers, 1908 p. 105.
Telake Chamberlin, 1919 p. 345.

Type species. *Glycera unicornis* Savigny in Lamarck, 1818.

Brief description. Prostomium distinctly annulated. Eyes absent. Pharynx cylindrical to dub-shaped, densely covered with numerous papillae. Distal part of pharynx with four dark, hook-like curved jaws and associated ailerons with a more or less triangular or deeply incised base. Biramous parapodia with dorsal and ventral cirri, and with two prechaetal and one or two postchaetal lobes. Branchiae present or absent, blister-like to simple, digitiform or branched, retractile in some species. Spinigerous compound chaetae only. Pygidium with a pair of slender anal cirri (Fiege and Böggeman, 2001).

***Glycera lapidum* Quatrefages 1866**

Glycera lapidum Quatrefages, 1866 p. 187.
Hamiglycera serrulifera Ehlers, 1908.
Glycera lapidum -Fauvel 1923 p. 386, fig. 151f-m; Wesenberg-Lund 1951 p. 50, 175 chart 24); Kirkegaard 1992 p. 166, fig. 78; 1995 p. 25; Kirkegaard 1998 p. 318, fig. 2; O'Connor 1987 p. 184, figs. 14-15.

Material examined. Atlantic Ocean. Bay of Biscay: St. Nazaire Canyon, St M84-5_643, 825 m, 2 spms; St M84-5_649, 1105 m, 10 spms; St M84-5_651, 982 m, 3 spms; St M84-5_653, 753 m, 2 spms; St M84-5_688, 667 m, 2 spms; **Cap Breton**, St M84-5_633, 221 m, 2 spms; St M84-5_677, 214 m, 13 spms; St M84-5_678, 215 m, 7 spms. **Gulf of Cadiz (CC): Moroccan Margin**, St TTR17-2_AT650, 326 m, 1 spm; St TTR17-2_AT654, 395 m, 1 spm; **Vernadsky Ridge**, St 64PE284_12758, 558 m, 1 spm; **Pen Duick Escarpment**, St 64PE237_05C, 533 m, 3 spms; St 64PE237_07, 570 m, 1 spm; St 64PE237_31, 559 m, 1 spm; St TTR16_AT602, 556 m, 1 spm; St 64PE253_23, 557 m, 1 spm; St 64PE253_26, 628 m, 1 spm; St 64PE253_40A, 560 m, 1 spm; St 64PE253_41, 568 m, 3 spms; St 64PE253_42, 637 m, 3 spms; St 64PE253_52, 622 m, 1 spm; St 64PE253_53, 651 m, 1 spm; St 64PE253_59, 637m, 2 spms; St 64PE268_04, 597 m, 1 spm; St 64PE268_05, 581 m, 1 spm; St 64PE268_09, 428 m, 1 spm; St 64PE268_36, 465 m, 2 spms; St 64PE268_39, 441 m, 2 spms; St 64PE268_42, 451 m, 1 spm; St 64PE268_45, ~800 m, 1 spm; St 64PE268_46, ~720 m, 3 spms; St 64PE268_51, ~740 m, 2 spms; St 64PE268_53, 750 m, 1 spm; St 64PE268_54, 750 m, 1 spm; **Mound B,** St 64PE268_11A, 489 m, 1 spm; St 64PE268_13A, 475 m, 2 spms; St 64PE268_13B, 493 m, 2 spms; St 64PE268_23A, 496 m, 1 spm; St 64PE268_24, 495 m, 1 spm; St 64PE268_25, 490 m, 2 spms; St 64PE268_27, 471 m, 3 spms; **Gulf of Cadiz (MV): Al Idrisi MV**, St 64PE253_46B, 227 m, 1 spm (cf.); **Mercator MV**, St TTR15_AT575, 355 m, 2 spms; St MSM01-3_237.2, 353 m, 2 spms; St MSM01-3_241, 353 m, 8 spms; St MSM01-3_242, 350 m, 6 spms; St 64PE253_48, 376 m, 4 spms; St 64PE253_49, 360 m, 2 spms; **Gemini MV**, St 64PE253_10, 432 m, 1 spm; St 64PE253_11, 438 m, 1 spm; St 64PE253_13, 516 m, 2 spms; St 64PE253_15, 600 m, 2 spms; St 64PE253_17, 612 m, 1 spm; St 64PE253_18, 608 m, 2 spms; St 64PE268_19, 430 m, 1 spm; **Kidd MV**, St TTR14_AT528, 489 m, 1 spm (cf.); **Anastasia Area**, St 64PE284_12706, 702 m, 1 spm; **Lazarillo MV**, St 64PE237_20, 516 m, 1 spm; St

64PE237_22, 518 m, 1 spm; St 64PE253_38A, 494 m, 2 spms; St 64PE253_38B, 497 m, 1 spm; **Meknès MV**, St TTR14_AT541, 703 m, 1 spm; St TTR15_AT586, 701 m, 1 spm; St MSM01-3_319, 695 m, 11 spms; St MSM01-3_321, 732 m, 3 spms; St MSM01-3_335, 703 m, 4 spms; St 64PE284_12748, 722 m, 3 spms; **Yuma MV**, St TTR16_AT604, 1030 m, 6 spms; St TTR16_AT605, 975 m, 2 spms; **Ginsburg MV**, St TTR16_AT607, 983 m, 7 spms; **Darwin MV**, St TTR16_AT608, 1115 m, 5 spms; St TTR17-2_AT664, 1128m, 4 spms; **Chechaouen MV**, St TTR16_AT610, 1177 m, 2 spms; **Captain Arutynov MV**, St TTR12_AT393, 1327 m, 1 spm; St TTR14_AT546, 1345 m, 1 spm; St MSM01-3_180, 1323 m, 21 spms; St MSM01-3_212, 1317 m, 5 spms; St MSM01-3_218, 1318 m, 3 spms; St MSM01-3_225, 1320 m, 8 spms; St MSM01-3_274, 1321 m, 9 spms; St MSM01-3_344, 1320 m, 1 spm; **Sagres MV**, St TTR17-2_AT667, 1562 m, 13 spms; **Carlos Ribeiro MV**, St MSM01-3_157, 2200 m, 1 spm; St MSM01-3_184, 2233 m, 2 spms; St JC10_054, 2179 m, 1 spm; **Unnamed Mound**, St TTR17-2_AT673, 2368 m, 1 spm; **Bonjardim MV**, St MSM01-3_149, 3089m, 1 spm; **Semenovich MV**, TTR17-2_AT679, 3265 m, 2 spms; **Porto MV**, St MSM01-3_167, 3862 m, 1 spm (cf.); St TTR17-2_AT683, 3890 m, 1 spm.
Mediterranean Sea. Alboran Sea (CS)**: Mulhacen MV**, St TTR17-1_MS416, 365 m, 1 spm; **Dakha MV**, St TTR17-1_MS413, 377 m, 2 spm; **Crow's Foot Pockmark**, St TTR17-1_MS425, 570 m, 1 spm; **Pockmark**, St TTR17-1_MS427, 657 m, 3 spm; **Reference Site,** St TTR17-1_MS384, 1022 m, 1 spm; Alboran Sea (CC)**: Melilla Coral Mound Field**, St TTR17-1_MS393, 245 m, 1 spm; East Mediterranean**: Cretan Sea**, RED10_05, 1018 m, 2 spms; St RED11_04, 1620 m, 2 spms; St RED11_05, 1018 m, 6 spms; St RED11_08, 1772 m, 4 spms; St RED11_09, 1194 m, 7 spms; **Kithira-Antikithira Strait**, St RED10_03, 2976 m, 1 spm; St RED10_03-1, 3314 m, 2 spms; St RED11_03, 2976 m, 4 spms; St RED11_03-1, 3314 m, 1 spm; **S Ierapetra Basin**, St RED10_02-1, 2720 m, 2 spms; St RED11_02, 2717 m, 1 spm; St RED11_02-1, 2720 m, 2 spms; **S of Crete Island**, St RED11_07, 3614 m, 1 spm.

Brief description. Prostomium with nine to twelve rings. Pharynx with two kinds of papillae: (1) conical to oval and (2) digitiform with crenulated edge. Ailerons with an expansion at the triangular base and well developed inner ramus united to the outer ramus by an inter-ramal plate. Segments triannulate. Branchiae absent. First two parapodia uniramous, following parapodia biramous. Parapodia with two prechaetal lobes, notopodial one much smaller than neuropodial, and one postchaetal lobe rounded and short. Dorsal cirri oval to rounded. Ventral cirri triangular to digitiform, slightly smaller than postchaetal lobe. Notochaetae simple capillary. Neurochaetae compound spinigerous. Pygidial cirri not observed (O'Connor, 1987; Böggemann, 2002).

Habitat. From 1 until 4400 m depth (Kirkegaard, 1998).

Distribution. North Atlantic Ocean (from Iceland to the Azores, including Norway and the eastern coast of North America; West Africa), Indian Ocean, Pacific Ocean (Kirkegaard, 1998).

Remarks. A total of 298 specimens were examined from the Gulf of Biscay to the Eastern Mediterranean, from 214 to 3890 m depth. Some morphological variability was observed among those specimens (including specimens from a same locality), concerning the shape of the ailerons and the

proportional length of the parapodial prechaetal lobes. A similar variability for the same features was already noticed by Støp-Bowitz (1941) and O'Connor (1987) for North Atlantic and Mediterranean specimens. Consequently, O'Connor (1987) considered *G. lapidum* as a species complex and described four different varieties. This species is also morphologically very similar to *G. capitata* Örsted, 1843, originally described from Greenland, with which have been many times confused in the past. Fauvel (1923) suggested the species *G. lapidum* to be a variety of *G. capitata* and was followed by many subsequent authors. The distinction between the two species was later confirmed by O'Connor (1987). *Glycera lapidum* differs form *G. capitata* by having two digitiform prechaetal lobes of which the dorsal is much smaller than the ventral one, and all its segments being triannulate instead of biannulate. According to O'Connor (1987), *G. capitata sensu* Fauvel (1923), Støp-Bowitz (1941) and Hartmann-Schröder (1971) are referred to variety C of *G. lapidum*.

Glycera lapidum was originaly described for the Mediterranean Sea at depths lower than 200 m, and is commonly found in Lusitanean area. However, it has also been recorded from northern waters until Iceland (e.g. Wesenberg-Lund, 1951; Kirkegaard, 1998, 2001), where it was found at depths deeper than 200 m and in both warm Atlantic waters (SW Iceland) and cold Arctic waters (N Iceland). The variability within the species and its wide geographic distribution (including Indian and Pacific Oceans) should be investigated more carefully with the inclusion of molecular tools.

Glycera noelae Böggemann, Bienhold and Gaudron, 2012

Glycera noelae Böggemann, Bienhold and Gaudron, 2012 p. 50, fig. 3

Material examined. Atlantic Ocean. Horseshoe Continental Rise: M Ivanov MV, St M86-5_348, 4497 m, 1 spm; St M86-5_407, 4507 m, 2 spms; **Tiamat MV**, St M86-5_339, 4551 m, 1 spm (cf.); **Site 2**, St M86-5_366, 4864 m, 1 spm (cf.); **Gulf of Cadiz (MV): Porto MV**, St TTR17-2_AT683, 3890 m, 1 spm.

Brief description. Prostomium conical with eight rings. Eyes absent. Pharynx long, cylindrical covered of digitiform papillae and conical to oval papillae. Terminal part of proboscis with four dark hook-shaped jaws with triangular base. First two pairs of parapodia uniramous, consisting of neuropodia, ventral cirri and compound chaetae only, and the following parapodia biramous. Dorsal cirri oval to globular.Ventral cirri slender triangular to digitiform. Branchiae absent. Notochaetae slender, straight or weakly recurved capillary. Neurochaetae compound spinigerous. Pygidium with a pair of slender, elongated cirri (Böggemann *et al.*, 2012).

Habitat. Near cold seeps, from 1694 until 4864 m depth (Böggemann *et al.*, 2012; this study).

Distribution. North Atlantic Ocean (Gulf of Cadiz); Eastern Mediterranean Sea (Böggemann *et al.*, 2012; this study).

Remarks. *Glycera noelae* was recently described by Böggemann *et al.* (2012) for specimens found at cold seeps from the East Mediterranean. This study extends the geographic and bathymetric distribution of this species to the Gulf of Cadiz and to 4864 m depth, respectively. The specimens studied herein were also found on a cold seepage area. *Glycera noelae* is morphologicaly similar to *G. capitata* Örsted, 1843 and *G. lapidum* Quatrefages 1866, differing mainly by the presence of transversal ridges on the pharynx papillae.

***Glycera tesselata* Grube, 1840**
Glycera tesselata Grube, 1840.
Glycera koehleri Roule, 1896.
Glycera sagittariae Fauvel, 1932.
Glycera tesselata Fauvel 1923 p. 387, fig. 152 a-c; Kirkegaard 1992 p. 169, fig. 80; 1995 p.27; Böggemann, 2002 and references therein p. 47, figs. 37–39; Imajima, 2003 p. 117, fig. 69h–l; Imajima, 2005 p. 81; Rizzo *et al.*, 2007 p. 46, fig. 13; Imajima, 2011 p. 171.

Material examined. Atlantic Ocean. Bay of Biscay: **Cap Breton**, M84-5_633, 221 m, 6 spms; St M84-5_678, 215 m, 2 spms; St M84-5_679, 216 m, 1 spm (cf.). **W Iberian Margin: Fontanelas**, St TTR17-2_AT691, 1308 m, 1 spm; **Gorringe Bank: Gettysburg Seamount**, St NA017_002, 2285 m, 2 spms; **Gulf of Cadiz (MV): Ginsburg MV**, St TTR16_AT607, 983 m, 4 spms; **Darwin MV**, St TTR16_AT608, 1115 m, 1 spm; St TTR17-2_AT664, 1128 m, 3 spms; St B09-14b_02W, 1100 m, 1 spm; **Captain Arutyunov MV**, St MSM01-3_225, 1320 m, 2 spms; St MSM01-3_274, 1321 m, 1 spm; **Sagres MV**, St TTR17-2_AT667, 1562 m, 1 spm; **Semenovich MV**, St TTR17-2_AT679, 3265 m, 1 spm.

Brief description. Conical prostomium with about 8 to 9 rings with 2 short antennae and 2 short palps. Pharynx papillae digitiform with straight, median, longitudinal ridge. Aileron with deeply incised base. Branchiae absent. Segments bi-annulated. Parapodia inserted on first ring. First two parapodia uniramous, and the following biramous. Dorsal cirri from third parapodium, conical to oval. Ventral cirri triangular to digitiform and shorter than the postchaetal lobes. Parapodia with simple capillary notochaetae and compound spinigerous neurochaeta (Rizzo *et al.*, 2007).

Habitat. From 20 until 3265 m (Kirkegaard, 1998; this study).

Distribution. Atlantic Ocean (from Faroes to West Africa; North Carolina), Indian Ocean, Pacific Ocean (Hawaiian, Mariana and Marshall Islands; Japan; Papua New Guinea) (Kirkegaard, 1998; Magalhães & Rizzo, 2012).

Remarks. *Glycera tesselata* was originaly described from the Mediterranean Sea at waters deeper than 300 m, where it was considered to be more common than in Atlantic Ocean proper (O'Connor, 1987). Although its distribution extends to the Faroes, this species is considered to be typical of warmer waters (Kirkegaard, 1998). In this study, *G. tesselata* was only found in Atlantic waters from the Gulf of Biscay to the Gulf of Cadiz. This species has also been recorded from the West Atlantic and the Indian and Pacific Oceans. However, this wide distribution should be considered with caution. In a recent record from South Brazil the authors denoted a small morphological difference at the insertion of the dorsal cirri on their specimens (at the base of the parapodia instead of far from it). This kind of differences may be found in other specimens from localities far from the type and should be carefully investigated. In this study the bathymetric distribution is extended from 1500 (Kirkegaard, 1998) to 3265 m.

***Glycera unicornis* Savigny in Lamarck, 1818**

Glycera goesi Malmgren, 1867.
Glycera kraussii Stimpson, 1856.
Glycera meckelii Audouin and Milne Edwards, 1833.
Glycera mesnili Saint-Joseph, 1898.
Glycera nicobarica Grube, 1866.
Glycera rouxii Audouin and Milne Edwards, 1833 (subjective synonym); Fauvel 1923 p. 389, fig. 153 a-c; Wesenberg-Lund 1951 p. 50, 176 (chart 25); Kirkegaard 1992 p. 168, fig. 79; Kirkegaard, 1998 p. 320.
Glycera goesi Ditlevsen 1929 p. 24.

Material examined. Atlantic Ocean. Gulf of Cadiz (MV): Al Idrisi MV, St 64PE253_46B, 227 m, 1 spm (cf.); **Mercator MV**, St TTR12_AT409, 375 m, 1 spm; St TTR12_AT410, 392 m, 1 spm; St TTR15_AT575, 355 m, 1 spm.

Brief description: Prostomium with eight rings. Pharyngeal papillae rounded and conical. Median segments biannulate. Pre-chaetal lamella pointed, post-chaetal lamella with chordate shape. Dorsal cirri oval. Ventral cirri long and pointed. Paired retractile branchiae from 20th chaetiger (O'Connor, 1987).

Habitat. From 10 until 4380 m depth (Kirkegaard, 1998).

Distribution. Eastern Atlantic (from Norway to South Africa), Indian Ocean, Pacific Ocean (Kirkegaard, 1998).

Remarks. *Glycera unicornis* was originaly described from the Mediterranean at depths lower than 200 m, but extends its distribution to Norway in the Atlantic Ocean. Herein this species was only found at the Gulf of Cadiz area. Its presence in the Indian and Pacific Oceans should be considered with

caution. *Glycera rouxii* Audouin & Milne Edwards, 1833 was recently considered as a synonym of *G.* unicornis (Böggemann, 2002).

- **Genus *Glycerella* Arwidsson, 1899**

Pseudolacydonia Rullier, 1964 (subjective synonym).

Type species. *Glycerella magellanica* (McIntosh, 1885).

Brief description. Prostomium with four rings with four distal appendages. Pharynx with rod-shape aileron. Parapodia uniramous in anterior segments with simple and capillary notochaetae, and spinigerous and falciger neurochaetae. The following parapodia are biramous, with dorsal and ventral cirri and have simple capillary notochaetae and compound spinigerous and falcigerous neurochaetae (Fauchald, 1977; Parapar and Moreira, 2009; Miranda *et al.*, 2014).

***Glycerella magellanica* (McIntosh, 1885)**

Hemipodus magellanicus McIntosh, 1885 p. 349, pl. XLII, figs. 11-15; pl. 22A, figs. 12-15; pl. 35a, figs. 5, 7.
Glycerella magellanica Arwidsson, 1899 p. 26, pl. II, fig. 22; pl. III, fig. 52-53, pl. IV, fig. 57; Fauvel, 1913 p. 77; Fauvel, 1914 p. 207; Hartman, 1950 p. 79. Hartman, 1964 p. 109, pl. XXXIII 8-9. Hartman, 1967 p. 87; Detinova, 1985 p. 113, fig. 2p; Jirkov, 2001 p. 218; Böggemann, 2002 p. 78, figs. 124-126; Imajima, 2005 p. 81, fig. 35a-i.
Glycerella atlantica Wesenberg-Lund, 1950 p. XXIV, pl. V, fig. 22; pl. VI, fig. 28; Amoureux, 1982 p. XLVI, fig. 8; O'Connor, 1987 p. 172, fig. 3.
Pseudolacydonia caeca Rullier, 1964 p. 151, fig. 8a-k.
Hemipodus magellanicus McIntosh, 1885 p. 349; pl. XLII, figs. 11–15; pl. XXIIa, figs. 12–15; pl. XXXVa, figs. 5, 7.
Glycerella atlantica Wesenberg-Lund, 1950 p. 24, pl. V, fig. 22; pl. VI, fig. 28; O'Connor, 1987 p. 21, fig. 3a–c.
Pseudolacydonia caeca Rullier, 1964 p. 151, fig. 8a–k.
Glycerella magellanica Böggemann, 2002 p. 78, figs. 124–126; Imajima 2005, 81, fig. 35a–i; Parapar & Moreira, 2009 p. 231, figs. 1–5.

Material examined. Atlantic Ocean. W Iberian Margin: Fontanelas, St TTR17-2_AT689, 1194 m, 1 spm; St TTR17-2_AT693, 1110 m, 1 spm; **Gorringe Bank**: **Gettysburg Seamount**, St NA017_002, 2285 m, 1 spm; St NA017_034, 1140 m, 1 spm. **Coral Patch Seamount**, St 64PE284_12767, 761 m, 1 spm; **Gulf of Cadiz (CC): Formosa Ridge**, St TTR12_AT388, 1079 m, 1 spm; **Pen Duick Escarpment**, St TTR12_AT406, 550 m, 1 spm; St 64PE268_51, ~740 m, 1 spm; **Central Carbonate Mound Province**, St 64PE284_12729, 754 m, 1 spm; **Gulf of Cadiz (MV): Mercator MV**, St JC10_018-Rock5, 373 m, 8 spms; St JC10_018-Rock7, 381 m, 1 spm **TTR MV**, St TTR12_AT416, 695 m, 2 spms.

Brief description: Prostomium with five rings, and four large antennae. Pharynx with digitiform papillae with a median longitudinal ridge. Aileron with a rod shape. First two parapodia uniramous

and the remaining ones biramous with slender triangular to digitiform prechaetal lobes, and notopodial lobe always much larger than the neuropodial. Dorsal cirri conical to oval from second segment. Ventral cirri large and digitiform. Median segments triannulated. Notopodial chaetae simple and neuropodial compound. Branchiae absent (Parapar & Moreira, 2009).

Habitat. Sublitoral from 45 to 2285 m depth (Böggemann, 2002; this study).

Distribution. North Atlantic Ocean (Iceland, Ireland, Azores), W Iberian margin, Gorringe Bank, Gulf of Cadiz, Pacific Ocean (Chile, Japan), Antarctic (Parapar & Moreira, 2009; this study).

Remarks. *Glycerella magellanica* was originally described by McIntosh (1885) for the Strait of Magellan in the Chilean coast and was recorded for the first time in the North Atlantic Ocean by Fauvel (1913, 1914) for the Azores Islands. Later, Wesenberg-Lund (1950) described a new species, *G. atlantica*, from Icelandic waters, that was also recorded by Amoureux (1982) from Irish waters. Detinova (1985) recorded again *G. magellanica* in Icelandic waters and considered *G. atlantica sensu* Amoureux (1982) as synonym of *G. magellanica*, but did not refer to the original description by Wesenberg-Lund (1950). Böggemann (2002) and Parapar & Moreira (2010) examined the type material of both *G. magellanica* and *G. atlantica*, and found no significant morphological differences that could justify the distinction of the two species. However, considering its very wide distribution, we agree with Parapar & Moreira (2009) that in the future, with the use of other morphological characters and molecular tools, this species may reveal to be a complex of species. In this study the bathymetrical distribution of *G. magellanica* is extended from 1960 (Böggemann, 2002) to 2285 m depth.

Family Goniadidae Kinberg, 1866

Goniadidae includes presently eight genera (*Bathyglycinde* Fauchald, 1972, *Glycinde* Müller, 1858, *Goniada* Audouin & Milne-Edwards, 1833, *Goniadella* Hartman, 1950, *Goniadides* Hartmann-Schröder, 1960, *Goniadopsis* Fauvel, 1928, *Progoniada* Hartman, 1965 and *Ophiogoniada* Böggemann, 2005) and 63 valid species (Böggemann, 2005). Goniadidae are morphologically very similar to Glyceridae with the main differences consisting on the possible presence of a subdistal and/or basal pair of subdermal eyes on the prostomium, the jaw and parapodia morphology, and the absence of branchiae. In Goniadidae specimens the pharynx ends in a series of macro- and micrognaths arranged in a more or less complete circlet. Additional chevrons (a pair of longitudinally arranged series of V-

shaped structures situated proximally on each side of the pharynx) are usually present. Their parapodia are uniramous in the anterior region and subbiramous or biramous in the posterior one (except for *Progoniada*, which has uniramous parapodia along the entire body). The uniramous parapodia have one or two prechaetal lobes, one postchaetal lobe and dorsal and ventral cirri. In the biramous parapodia the noto- and neuropodial rami are well separated, notopodia have a single lobe or are subdivided into small pre- and postchaetal lobes and neuropodia have one or two pre- and postchaetal lobes. In the subbiramous parapodia the notopodial rami are represented only by the aciculae and chaetae. The notochaetae are simple or acicular, the neurochaetae are compound spinigers or falcigers. The transition between uniramous and biramous parapodia may be abrupt or a transitional middle region with gradually changing parapodia may be present (Figure 22) (Rouse & Pleijel, 2001; Böggemann, 2005).

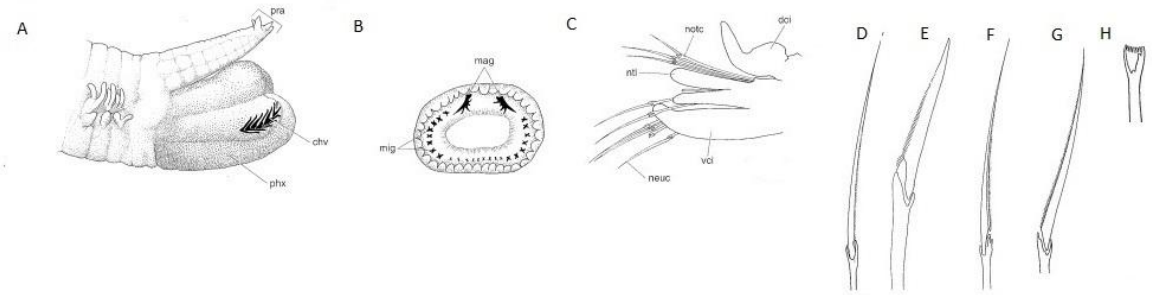

Figure 22. Representative scheme of goniadid morphology. A. Anterior end of goniadid species with proximal part of pharynx everted. B. Macro- and micrognaths of the pharynx of *Glycinde armigera*. C. Anterior parapodia of *Goniada* species. D, E, F. Compound chaetae from middle segment. G. Heterogomph spinigerous chaetae from middle segment. H. Homogomph spinigerous shaft chaetae. Legend: chv - chevron; dci - dorsal cirri; mag - macrognaths; mig - micrognaths; pra - prostomial appendages; notc - notochaetae with spine-like shape; neuc - compound neurochaetae; ntl - notopodial lobes; vci - ventral cirri (after Wilson, 2000b).

Goniadid's (Figure 23) are benthic polychaetes found at all depths, from intertidal to abyssal plains, most commonly in intertidal and sublittoral depths, but rarely in high densities. Comparatively to glycerids they are more common in deeper waters (Fauchald & Jumars, 1979). They are considered carnivorous, with some species feeding primarily on burrowing, deposit-feeding polychaetes (in contrast to Glyceridae, which feeds on errant polychaetes) and they capture preys with the jaws located on distal part of proboscis (Blegvad, 1914; Hunt, 1925; Fauchald & Jumars, 1979).

Figure 23. *Goniada maculata.* (Author: Claude Nozères, source: http://biocache.ala.org.au/occurrences/f208a576-f814-4c5f-a935-40be1ecab7ab).

- **Genus *Glycinde* Müller, 1858**

Epicaste Kinberg, 1866 p. 247.
Eone Malmgren, 1866 p. 409.

Type species. *Glycinde multidens* Müller, 1858

Brief description. Prostomium annulated with biarticulate appendages. Pharynx with several different types of papillae, arranged in distinct longitudinal rows, with macrognaths and microgaths, and without chevrons. Parapodia uniramous on anterior region and biramous on posterior one. Notochaetae stout, hooked at tip and with terminal pointed hood; neurochaetae compound spinigers (Böggemann, 2005).

***Glycinde nordmanni* (Malmgren, 1866)**

Eone Nordmanni Malmgren, 1866 p. 409; Malmgren, 1867 p. 163, pl. XII, fig. 64 a-d.
Goniada oculata Treadwell, 1901 p. 201, figs. 50-53.
Eone longepapillata Voit, 1911 p. 114, figs. 11–12.
Eone nordmanni Fauvel 1923 p. 394-395, fig. 155 h-n.
Glycinde nordmanni Helgason *et al.* 1990 p. 209; Kirkegaard 1992 p.172, fig. 81; 1998 p. 520.

Material examined. Atlantic Ocean. Bay of Biscay: Cap Breton, St M84-5_677, 214 m, 1 spm; St M84-5_678, 215 m, 1 spm; St M84-5_679, 216 m, 2 spms.

Brief description. Prostomium with about ten rings. A pair of subdistal and/or basal subdermal eyes may be present. Pharynx with several different types of papillae: mid-dorsal papillae small teapot-shaped with laterally directed tip (1 row), dorso-lateral papillae short tridentate with broad base (1 row) followed by longer fang-shaped ones (5 rows), lateral papillae rectangular with narrow bases and short lateral tips (3 rows), latero-ventral ones duckfoot-shaped (1 row) followed by strait conical ones (1 row)

and double row of spatulate papillae without cilia in dorso-basal part below prostomium. Macrognaths tri- to quinquedentate, 4–32 dorsal compound microgaths, ventral microgaths and chevrons absent. Approximately 33–40 chaetigers with uniramous parapodia, which have conical to digitiform prechaetal lobe and one shorter rounded to conical postchaetal lobe. The following ones biramous with conical notopodial prechaetal lobes and distinctly shorter rounded postchaetal lobes. Dorsal and ventral cirri digitiform in anterior and posterior chaetigers, becoming more conical medially, of about the same size as parapodial lobes. Notochaetae stout, hooked at tip, with terminal pointed hood. Neurochaetae compound spinigers with blades of different lengths (Böggemann, 2005).

Habitat. From 9 to 470.31 m depth (Böggemann, 2005).

Distribution. North Atlantic Ocean (Gulf of Mexico; Mediterranean Sea) (Böggemann, 2005).

Remarks. Up to date, *G. nordmanni* is the only *Glycinde* species recorded for the North Atlantic area. The specimens studied herein match entirely the description of this species with the possible exception of the pharynx papillae that could not be observed. In 1982, Amoureux described specimens from depths up to 1400 m, although this range of depth has not been cited again.

- **Genus *Goniada* Audouin & Milne Edwards, 1833**

Leonnatus Kinberg, 1866 p. 247.

Type species. *Goniada emerita* Audouin & Milne Edwards, 1833 p. 268; pl. XVIII, figs. 1–4.

Brief description. Prostomium annulated, with some distinguishable rings and terminal annulus with biarticulate appendages. Pharynx with a few different types of papillae,commonly with macrognaths and dorsal and ventral microgaths and chevrons usually present. Anterior part of the body with uniramous parapodia and the following with biramous parapodia. Notochaetae capillary or acicular and neurochaetae usually compound spinigers. Some smaller specimens may have additional falcigers on anterior chaetigers (Böggemann, 2005).

***Goniada vorax* (Kinberg, 1866)**

Leonnatus vorax Kinberg, 1866 p. 247; Kinberg, 1910 p. 60, pl. XXI, figs. 10 b-c, f-g.
Goniada pallida Arwidsson, 1899 p. 43, pl. II, figs. 35–39.
Goniada distorta Moore, 1903 p. 461, pl. XXVI, fig. 77.
Goniada maorica Benham, 1932 p. 555, figs. 1–5.

Goniada sagamiana Imajima, 2003 p. 121, figs. 72–74.

Material examined. Atlantic Ocean. Biscay Bay: Cap Breton, St M84-5_678, 215 m, 1 spm.

Brief description. Prostomium with eight-nine rings, a pair of subdermal eyes may be present. Pharynx with ventral conical bifid tips and dorsal heart-shaped to rectangular papillae, H+v/w-shaped dorsal and ventral compound micrognaths and about nine to thirty six pairs of chevrons. Chaetae from second segment. About fourty five to sixty nine uniramous parapodia and the following ones biramous. Dorsal cirri on anterior segments digitiform, shorter than neuropodial lobes and elongated and more digitiform in posterior segments. Ventral cirri digitiform in anterior segments about as long as neuropodial postchaetal lobes and elongated and more digitiform in posterior ones. Notochaetae capillary and neurochaetae spinigers (Böggeman 2005).

Habitat. From 7.32 to 512 m depth (Böggeman, 2005).

Distribution. North Atlantic Ocean (Caribbean Sea; Mediterranean Sea), Indian Ocean, Western Pacific Ocean (Böggeman 2005).

- **Genus *Ophiogoniada* Böggemann, 2005**

Type species. *Ophioglycera lyra* Granados-Barba & Solís-Weiss, 1997.

Brief description. Prostomium annulated with biarticulate appendages. Pharynx with slightly different types of papillae, with macro- and micrognaths and without chevrons. First segment without parapodia or chaetae, only a pair of small cirri present. Parapodia uniramous on anterior region and biramous on posterior one, with acicular notochaeta, compound spinigers neurochaetae and a few additional lyrate chaeta in superior position (Böggemann, 2005).

***Ophiogoniada* sp.**

Material examined. Atlantic Ocean. Gulf of Cadiz (MV): Kidd MV, St TTR14_AT528, 489 m, 1 spm.

Remarks. Only one specimen of *Ophiogoniada* was found in Gulf of Cadiz. At present, the genus *Ophiogoniada* includes one species, *O. lyra* (Granados-Barba & Solís-Weiss, 1997), originally described from Gulf of Mexico as belonging to the genus *Ophioglycera* and recorded for the SW Atlantic and E

Indian Oceans, from 16 to 250 m depth. The lyriform chaetae characteristic of this species was not found in the specimen examined herein thus preventing its identification as *O. lyra*.

- **Genus *Progoniada* Hartman, 1965**

Type species. *Progoniada regularis* Hartman, 1965b.

Brief description. Prostomium consisting of eight rings with biarticulate appendages, which may be appear to be tri- or quadriarticulated due to constrictions of the basal article. Pharynx with a few different types of papillae, macrognaths, micrognaths and chevrons. First segment with only a pair of small lateral cirri and without parapodia or chaetae. All parapodia uniramous, with compound falcigers and/or spinigers neurochaetae (Böggemann, 2005).

cf. *Progoniada* sp.

Material examined. Atlantic Ocean. Bay of Biscay: Cap Breton, St M84-5_678, 215 m, 1 spm. **Mediterranean Sea. Alboran Sea (CC): Mellilla Coral Mound Field**, St TTR17-1_MS393, 245 m, 1 spm.

Remarks. Only two very small specimens were found in Gulf of Cadiz and Alboran Sea, for which a certain generic and specific determination was not possible. The genus *Progoniada* includes at present only one valid species, *Progoniada regularis* Hartman, 1965, originaly described from the NW Atlantic Ocean and with a very wide geographical distribution, from the Arctic to the Antarctic including the Atlantic, Indian and Pacific Oceans and from 10–5448 m depth (Böggemann, 2005).

Suborder Phyllodociformia

Family Phyllodocidae Örsted, 1843

Phyllodocidae is a very diverse polychaete family that includes 20 genera and about 500 nominal species (Oliveira, 2013). The first described species (*Eulalia viridis* and *Phyllodoce maculata)* were originally ascribed to *Nereis* by Linnaeus (1767). The family was posteriorly established by Örsted (1843a). Many new taxa within the family were described in the nineteen century, especially by Quatrefages (1866), Örsted (1842, 1843a, b), Grube (1857, 1878), Schmarda (1861), Malmgren

(1865), Kinberg (1866), Claparède (1868) and Saint-Joseph (1888). In the following years several changes were made within the family, by authors such as Bergström (1914), Fauvel (1923), Day (1967) and Ushakov (1972) with the inclusion of many pelagic species. In 1977, Fauchald suggested a new classification of the polychaete families based on phylogenetic criteria and definitely separated the pelagic forms from the benthic ones, placing them into several different families (Alciopidae, Pontodoridae and Lopadorhynchidae). More recently, the phylogeny of the Phyllodocidae has been revised by Pleijel (1991), Eibye-Jacobsen (1993), Orrhage and Eibye-Jacobsen (1998), and Eklöf *et al.* (2007), among others, for less inclusive groups within the family, but a consensus about the monophyly of the family and its subfamilies has not yet been achieved. Nevertheless, there are some morphologic characters that support the family's monophyly: the leaf-like parapodial cirri, the reduced notopodia and the presence of spinigerous chaetae (Oliveira, 2013). Important revisions on some phyllodocid genera were made by many authors such as Wilson (1988), Eibye-Jacobsen (1991a, b), Pleijel (1990, 1993a), Kato and Pleijel (2002, 2003) and Nygren and Pleijel (2011). The most recent studies of the family for Northern Europe include Pleijel and Dales (1991), Kirkegaard (1992), Pleijel (1993b) and Hartmann-Schröder (1996).

The phyllodocids, commonly known as "paddle-worms", due to their characteristic paddle shape dorsal cirri, are benthic polychaetes found in all kinds of substrata as mud, sand, shell gravel, and rocky bottoms (Rouse & Pleijel, 2001). Although the majority of phyllodocids live in littoral and sublittoral zones (until 200 m depth), including estuarine waters (Uschakov, 1972), some taxa occur at greater depths. They are active, errant, free-living predators or scavengers (Rouse & Pleijel, 2001; Eklöf, 2010). Specimens vary from a few millimeters to about a meter and may exhibit a variety of colors like white, silver, green, red, yellow, golden, brown and even black (Figure 24).

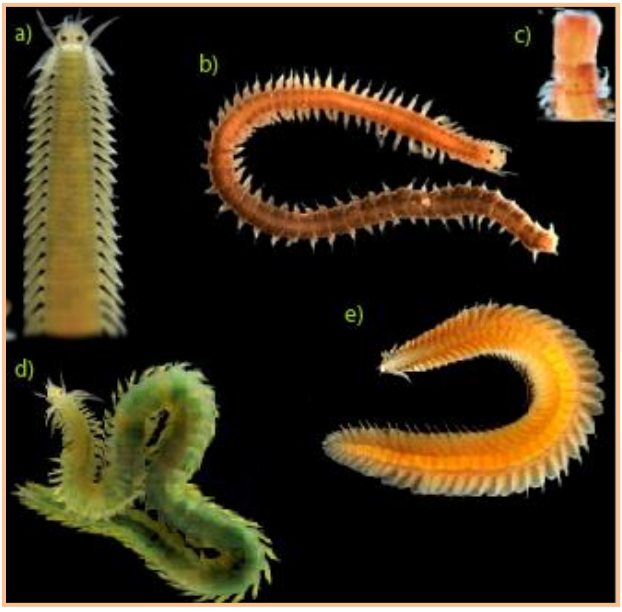

Figure 24. Phyllodocid specimens. a) *Eumida sanguinea* (from Pleijel & Nygren, 2011); b) *Phyllodoce* (*Anaitides*) *rosea* (by Hans Hillewaert, source: http://www.marinespecies.org/photogallery.php?album=673&pic=690); c) *Phyllodoce longifrons* (from Çinar & Dagli, 2012); d) *Eulalia viridis* (by Fredrik Pleijel, source: http://www.forskning.no/artikler/2011/november/305400); e) *Paranaitis katoi* (from Nygren *et al.*, 2009).

Morphologically, the phyllodocid's are distinguished from other polychaete families mainly by the leaf-like shape of the parapodial dorsal cirri (Wilson, 2000c). Individuals of this family have a long and slender body with many uniform segments (Alós, 2004). The prostomium is usually well differentiated in many shapes: conical, rounded, ovate or pentagonal. It bears a dorsal pair of antennae and a ventral pair of palps with similar length and shape (Rouse & Pleijel, 2001; Alós, 2004; Oliveira, 2013), and a pair of eyes (located on the posterior part of the prostomium) (Alós, 2004) that can be superficial or subdermal (Pleijel, 1991) (Figure 25). The prostomium may also have a median antenna located on the anterior, median or posterior part, and a nuchal papilla located posteriorly. The pharynx is muscular, large and cylindrical and is typically covered by conical, rounded or digitiform papillae, uniformly distributed or grouped in longitudinal lines. There are no mandibles on the distal part of the pharynx (Alós, 2004). The first segment may be completely visible dorsally, partially covered by the posterior part of prostomium or dorsally reduced. The tentacular segments may be partially fused and have two to four pairs of tentacular cirri distributed according to the rule "1+2+1" (one pair on the first segment, two pairs on the second segment and one pair on the third segment). The dorsal and ventral cirri are usually leaf-like, the dorsal cirri being much larger than the ventral ones. The parapodia may be uniramous or biramous and there are no chaetae on the first segment (Wilson, 2000c). The spiniger

shape of chaetae is almost the same in all members of the family (Alós, 2004). The pygidium bears a pair of pygidial cirri.

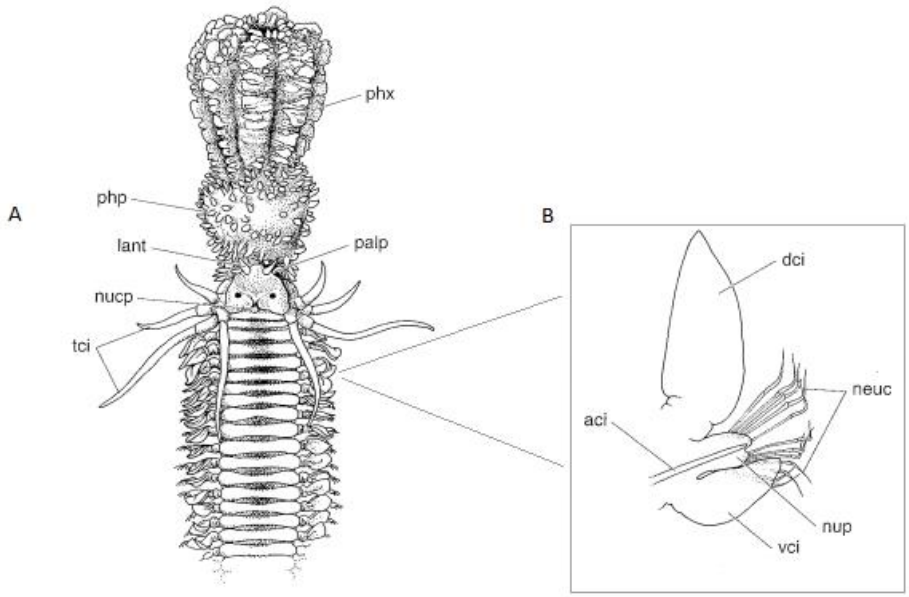

Figure 25. Representative scheme of a phyllodocid morphology. A. Anterior end with the pharynx everted, dorsal view. B. Median parapodium. Legend: aci - aciculum; dci - dorsal cirri; lant - lateral antennae; neuc- neuropodial chaetae; nucp - nuchal papilla; nup-neuropodium; palp - palp; php - pharyngeal papillae; phx - pharynx; vci – ventral cirri; tci - tentacular cirri (after Wilson, 2000c).

- **Genus *Eulalia* Savigny in Lamarck, 1818**

Eulalia Savigny in Lamarck, 1818 p. 45.
Hypoeulalia Bergström, 1914 p. 165.
Notalia Bergström, 1914 p. 127.
Steggoa Bergström, 1914 p. 129.

Type species. *Nereis viridis* Linnaeus, 1767 by subsequent designation (Bergström 1914).

Brief description. Prostomium rounded to oblong, with a pair of antennae and palps and a median unpaired antenna. Eyes may not be visible. Pharynx with rounded to conical papillae diffusely distributed. First segment completely visible dorsally. Four pairs of cylindrical tentacular cirri (1+2+1). Parapodia uniramous. Dorsal cirri ovate, longer than wide. Ventral cirri ovate or pointed, longer than wide. Chaetae present from second or third segment. Compound chaetae spinigerous. Capillary

chaetae may be present. Pygidium with a pair of cylindrical or rounded cirri, median papilla present or absent (Pleijel & Dales, 1991; Alós, 2004).

Eulalia spp.

Material examined. **Atlantic Ocean.** **Bay of Biscay: St. Nazaire Canyon**, St M84-5_649, 1105 m, 2 incompl. spms; **Cap Breton**, 17-06-2011, St M84-5_677, 214 m, 1 spm; **Pagès**, St M84-5_602, 594 m, 1 spm. **W Iberian Margin: Fontanelas**, St TTR17-2_AT690, 1340 m, 1 spm. **Gorringe Bank: Gettysburg Seamount**, St NA017_002, 2285 m, 1 incompl. spm. **Gulf of Cadiz (MV): Mercator MV**, St TTR15_AT575, 355 m, 2 incompl. spm (cf.); **Captain Arutyunov MV**, St MSM01-3_195, 1390 m, 1 incompl. Spm; **Carlos Ribeiro MV**, St TTR16_AT618, 2220 m, 1 incompl. spm (cf.).

Remarks. The distinction between *Eulalia* species is frequently based on pigmentation patterns that are lost after fixation of the specimens. This factor together with the lack of relevant bibliography limited the identification of the specimens examined. There are however four potentially different species, one of which (from Gulf of Cadiz) might be *E. meteorensis* Böggemann, 2009, described for the Gulf of Guinea at 5137–5141m depth. Nevertheless, there are several described species that are possible to occur in these geographical regions for which the descriptions could not be verified. The use of molecular tools would also be recommended in future analyses of these specimens.

- ## Genus *Eumida* Malmgren, 1865

Eumida Malmgren, 1865 p. 97.

Type Species. *Eumida Sanguinea* Örsted, 1843a.

Brief description. Prostomium pentagonal with three antennae and a pair of palps. Eyes may not be visible. Pharynx with difusely distributed micropapillae (macropapillae may be present in some species) and an oral ring of larger papillae, each with 2-3 longitudinal rows of micropapillae. First segment reduced dorsally. Four pairs of cylindrical tentacular cirri (1+2+1), ventral cirri of segment 2 somewhat flattened. Parapodia uniramous. Dorsal cirri cordiform, rarely rounded. Ventral cirri oval or pointed. Chaetae present from second segment. Compound spinigerous chaetae. Pygidium with a pair of cylindrical anal cirri, median papilla present or absent (Eibye-Jacobsen, 1991a; Alós, 2004).

Eumida (Eumida) cf. *longicirrata* Hartmann-Schröder, 1975

Eumida (Eumida) longicirrata Hartmann-Schröder, 1975 p. 55, figs. 16-18.
Eumida longicirrata Campoy, 1982 p. 156; Alós, 2004 p. 136, fig. 43.

Material examined. **Atlantic Ocean.** Gulf of Cadiz (MV): **Bonjardim MV**, St TTR17-2_AT678, 3060 m, 1 compl. spm.

Brief description. Prostomium pentagonal with three antennae and a pair of palps, all longer than the prostomium length. Median antennae thinner, inserted on the anterior region of prostomium. Eyes absent. Two raised semicircular structures with dark margins (resembling eyes) present in posterior corners of prostomium. Pharynx smooth. First segment completely reduced dorsally. Second segment without dorsal cirri. Dorsal cirri elongate lanceolate, somewhat asymetrical. Ventral cirri broadly elongate, longer than neuropodium. Cirri and anal papilla not observed (Eibye-Jacobsen, 1991a; Alós, 2004).

Habitat. From 3060 until 5260 m depth (Eibye-Jacobsen, 1991a; Alós, 2004; this study).

Distribution. Northeast Atlantic (Iberian basin) (Eibye-Jacobsen, 1991a; Alós, 2004); Gulf of Cadiz (this study).

Remarks. *Eumida longicirrata* differs from another species of the genus by the absence of eyes and presence of semicircular structures located on the position of the corners of the prostomium (Eybie-Jacobsen, 1991a). The specimen examined in this study also lacks eyes, although the presence of the raised corner structures could not be confirmed with certainty, possibly due to the dark colour of the specimen. All other characteristics of the species were verified. Two other species, *E. alvini* Eibye-Jacobsen, 1991 from NW Atlantic (1830-3995 m depth) and *E. nuchala* (Uschakov, 1972) from NE Pacific (abyssal), lack eyes as well as the corner structures. However, both species differ from *E. longicirrata* and from the specimen examined here, by the position of median antennae, the shape of dorsal cirri and the length of chaetae. *Eumida longicirrata* was only known from its type locality in the Iberian basin, at 5260 m depth. The present record extends the geographical distribution of this species to the Gulf of Cadiz and its bathymetric superior limit to 3060 m depth.

- **Genus *Eteone* Savigny in Lamarck, 1818**

Eteonella McIntosh, 1874b p. 197.
Mysta Malmgren, 1865 p. 100-101.

Type Species: *Nereis flava* Fabricius, 1780 by subsequent designation (Bergström, 1914).

Brief description: Prostomium rounded to oblong, with a pair of antennae and palps. Eyes visible. Nuchal papilla present posteriorly. Pharynx smooth or with papillae. First segment completely reduced. Two pairs of tentacular cirri. Parapodia uniramous. Dorsal cirri rounded, ventral cirri rounded or pointed. Dorsal cirri absent from the third segment. Chaetae present from the third or fourth segment. Pygidium with a pair of cylindrical cirri, without median papilla (Wilson, 1988; Pleijel & Dales, 1991; Alós, 2004).

cf. *Eteone* sp.

Material examined. Atlantic Ocean. Bay of Biscay: St. Nazaire Canyon, St M84-5_649, 1103 m, 1 compl. partially dried spm.

Remarks. Only one very small and partially dried specimen was examined and a clear determination of the genus and species was not possible. The species that are known to occur at the sampled areas are *Eteone barbata* Malmgren, 1865, *Eteone flava* (Fabricius, 1780), *Eteone longa* (Fabricius, 1780), *Eteone siphodonta* (delle Chiaje, 1822), *Eteone spetsbergensis* Malmgren, 1865, *Eteone suecica* Bergström, 1914, and *Eteone tetraophthalma* Schmarda, 1861.

- **Genus Mystides Théel, 1879**

Mystides Théel, 1879 p. 35.
Mesomystides Czerniavsky, 1882 p. 147.

Type species. *Mystides borealis* Théel, 1879.

Brief description. Prostomium rounded, with a pair of very thin antennae and palps. Eyes may not be visible. Pharynx with rounded papillae diffusely distributed. First and second segments may be fused. Three pairs of bottle-shaped tentacular cirri (1+2). Parapodia uniramous. Dorsal cirri rounded, flattened or swollen, absent from third segment. Ventral cirri rounded. Chaetae present from second segment. Pygidium with a pair of rounded or cylindrical cirri and a median papilla (Pleijel & Dales, 1991; Alós, 2004).

***Mystides caeca* Langerhans, 1880**

Mystides caeca Langerhans, 1880 p. 310, pl. 17, figs. 42 a-d; Pleijel and Dales, 1991 p. 64, fig. 11; Pleijel, 1993b p. 129, figs. 90-91; Jirkov, 2001 p. 87; Böggemann, 2009, p. 360, fig. 95.
Mystides (Mesomystides) borealis Southern, 1914.

Material examined. Atlantic Ocean. Bay of Biscay: St. Nazaire Canyon, St M84-5_651, 982 m, 2 spms. **Azores EEZ: Atlantis Seamount,** St TTR12_AT422, 375 m, 1 spm.

Brief description. Prostomium rounded, wider than long, with cirriform antennae and palps. Antennae longer than palps. Eyes not visible. Anterior two segments partially fused dorsally. Tentacular cirri bottle-shaped with cirriform tips. Dorsal and ventral cirri ovate, swollen. Chaetae present from second segment. Compound chaetae with rostrum of shaft symmetrical, with one larger tooth and a number of smaller ones on each side. Blades very long and slender. Pygidium with a pair of ovate cirri, similar to dorsal cirri, and a median papilla (Pleijel & Dales, 1991; Böggemann, 2009).

Habitat. Mud, sand, shell gravel and rocky bottoms. European records up to 400 m depth (Pleijel & Dales, 1991), West African records up to 5496 m depth (Böggemann, 2009).

Distribution. East Atlantic (Skagerrak, East coast of England, English Channel, western Ireland, Madeira, Angola, Cape and Guinea Basins) (Pleijel & Dales, 1991; Böggemann, 2009).

Remarks. *Mystides caeca* was first described for specimens from Madeira. This species is morphologically very similar and have a close European geographical and bathymetrical distribution to *M. borealis* Théel, 1879 that was initially described for specimens from Siberia. The two species differ mainly by the presence of eyes on *M. borealis*, which are absent on *M. caeca*. The recent records of *M. caeca* for Guinea, Angola and Cape Basins, at depths between 5048 and 5496 m (Böggemann, 2009), greatly extended the distribution of this species. However, this large distribution should be considered with caution and be confirmed with further studies on the South African and North European specimens, preferably including the use of molecular tools.

- **Genus *Nereiphylla* Blainville, 1828**

Nereiphylla Blainville 1828. *Dict. Sci. Nat.*, 57 p. 465.
Genetyllis Malmgren, 1865 p. 93.

Type species. *Nereiphylla paretti* Blainville, 1828.

Brief description. Prostomium rounded, with a pair of antennae and palps. Large rounded eyes. Nuchal papilla absent. Pharynx very long and slender, with diffusely distributed papillae. First and second segments fused. Four pairs of tentacular cirri (1+2+1) thick with tapering tips. Parapodia

uniramous. Dorsal cirri heartshaped. Ventral cirri with long axis obliquely oriented. Pygidium with a pair of cylindrical and pointed cirri (Pleijel & Dales, 1991; Alós, 2004).

***Nereiphylla* sp.**

Material examined. Atlantic Ocean. Gulf of Cadiz (CC): Pen Duick Escarpment, St TTR12_AT406, 550 m, 1 compl. spm, partially dried.

Remarks. The only specimen examined was partially dried and lacked antennae, palps, tentacular cirri and the majority of dorsal cirri, making impossible further taxonomic determination. Nevertheless, the diagnostic characteristics of the genus was confirmed (small rounded prostomium with large rounded eyes, nuchal papillae absent, first two segments fused, parapodia uniramous with large obliquely oriented ventral cirri).

- **Genus *Notophyllum* Örsted, 1843**

Notophyllum Örsted, 1843a p. 25.
Phyllodoce (Macrophyllum) Schmarda, 1861 p. 82.
Eunotophyllum Czerniavsky, 1882 p. 149.
Pseudonotophyllum Czerniavsky, 1882 p. 150.
Paraeulalia Czerniavsky, 1882 p. 171.
Trachelophyllum Levinsen, 1883 p. 209.
Hesperophyllum Chamberlin, 1919 p. 4.
Nipponophyllum Imajima and Hartman, 1964 p. 66.

Type species. *Phyllodoce foliosum* Sars, 1835 by subsequent designation (Bergström, 1914).

Brief description. Prostomium, pentagonal or triangular, with a pair of antennae and palps and a median unpaired antenna. Large rounded eyes. Large nuchal epaulettes present. Pharynx with lateral rows of rounded, discoidal or hook-shaped papillae and a group of large papillae in proximal-most dorso-lateral part. Dorsal and ventral surfaces of proximal part covered by minute rounded papillae, distal part covered by large rounded to flattened papillae. First segment not visible dorsally. Four pairs of tentacular cirri (1+2+1). Parapodia biramous. Dorsal cirri reniform, much wider than long. Ventral cirri rounded. Chaetae present from the second segment. Compound chaetae spinigerous. Pygidium with a pair of flattened and rounded cirri and a median papilla (Pleijel & Dales, 1991; Kato & Pleijel, 2002; Alós, 2004).

***Notophyllum* sp.**

Material examined. Atlantic Ocean. Gulf of Cadiz (CC): Formosa Ridge, St TTR12_AT388, 1079 m, 1 incompl. spm.

Remarks. The only specimen examined was incomplete and lack all dorsal cirri. Nevertheless, the presence of very large rounded eyes, median antennae (broken) inserted between the eyes, nuchal epaulettes with two lobes at the tip, first segment reduced, parapodia biramous with clearly visible notoacicula and large dorsal cirrophores, unequivocally places this specimen within the genus *Notophyllum*. *Notophyllum foliosum*, originally described from Norway, has been the most recorded species for NE Atlantic and Mediterranean Sea, within depths of 10-1280 m (Kato & Pleijel, 2002). However, Nygren *et al.* (2010) re-examined the type material of *N. foliosum*, along with new material from Norway and Sweden, and distinguish the shallower forms (20-125 m depth) from the deeper ones (101-350 m depth), based on different colouration patterns and molecular evidence. They described a new species, *N. crypticum*, for the deeper forms. Furthermore, those authors consider as questionable any possible synonymy between these two species and *N. alatum* Langerhans, 1880 and *N. frontale* Langerhans, 1880, originally described from Madeira Island, as previously established by Kato and Pleijel (2002). Therefore, all records of *N. foliosum* from S Europe need to be revised, along with the type material of *N. alatum* and *N. frontale*. Since the morphologic distinction between phyllodocid congeneric species is frequently based exclusively on colour patterns (e.g. Nygren *et al.* 2009, 2010), molecular analyses of the specimens should be done whenever possible.

- **Genus *Paranaitis* Southern, 1914**

Paranaitis Southern, 1914 p. 66.
Anaitis Malmgren, 1865 p. 94.
Eulalia (*Euphylla*) Knox, 1960 p. 113.
Pareteone Hartmann-Schröder, 1975 p. 58.
Compsanaitis Hutchings & Murray, 1984 p. 24.

Type species. *Anaitis wahlbergi* Malmgren, 1865.

Brief description. Prostomium anteriorely rounded, with a pair of antennae and palps. Eyes may not be visible. Nuchal papilla if present located posteriorly at the end of a distinct ligula. Pharynx with papillae of different shapes and distribution. First and second segments fused covering the posterior part of the prostomium. Four pairs of cylindrical tentacular cirri (1+2+1). Parapodia uniramous. Dorsal

cirri rounded, asymmetrical. Ventral cirri oval, usually longer than wide. Chaetae present from second or third segments. Pygidium with a pair of rounded cirri and median papillae (Pleijel & Dales, 1991; Kato & Pleijel, 2003; Alós, 2004).

cf. *Paranaitis* sp.

Material examined. Atlantic Ocean. Bay of Biscay: Cap Breton, St M84-5_633, 221 m, 1 incompl. spm.

Remarks. The only specimen examined was incomplete and in very poor condition and thus the diagnostic characteristics of the genus could not be fully confirmed. Three species of *Paranaitis* have been recorded for south European waters, *P. wahlbergi* (Malmgren, 1865) (from Norway to the Mediterranean, 10-1200 m), *P. kosteriensis* (Malmgren, 1867) (from Norway to the Mediterranean, infralittoral) and *P. abyssalis* (Hartmann-Schröder, 1975) (NW Spain, 5260 m) (Pleijel & Dales, 1991; Kato & Pleijel, 2003; Alós, 2004). Nygren *et al.* (2009) examined specimens of *P. wahlbergi* from the Arctic and boreal regions and described a new species for the boreal region, *P. katoi*, based mainly on body, egg size and molecular evidence. However, they did not verify the southern European records. These records may thus belong to the species *P. katoi*, or to a new species and need to be further investigated.

- **Genus *Phyllodoce* Savigny in Lamarck, 1818**

Phyllodoce Savigny *in* Lamarck, 1818 p. 316.
Lepadorhynchus Schmarda, 1861 p. 88
Anaitides Czerniavsky, 1882 p. 158.
Carobia (*Paracarobia*) Czerniavsky, 1882 p. 158, in part.
Carobia (*Protocacabia*) Czerniavsky, 1882 p. 155, in part.
Globidoce Bergström, 1914 p. 87 (error for *Sphaerodoce* Bergström, 1914).
?*Prophyllodoce* Hartman, 1966 p. 187.
Zverlinum Averintsev, 1972 p. 106.
Phyllodoce (*Aponaitides*) McCammon and Montagne, 1979 p. 363-364.
Phyllouschakovius Blake, 1988 p. 254.

Type species. *Phyllodoce laminosa* Savigny in Lamarck, 1818.

Brief description. Prostomium longer than wide, bilobed posteriorly, with a pair of antennae and palps. Eyes visible. Nuchal papilla located at the posterior incision of the prostomium. Pharynx divided in proximal and distal parts. Proximal part with conical papillae, either uniformly distributed or in

more or less distinct rows, distal part with rows of tubercles. First segment anteriorly covered by prostomium. Four pairs of elongated and cylindrical tentacular cirri (1+2+1). Parapodia uniramous or sometimes (rarely) biramous. Dorsal cirri rounded or cordiform. Ventral cirri ovate or pointed. Chaetae present from the second, third or fourth segment. Compound chaetae spinigerous. Pygidium with a pair of pointed and cylindrical cirri, without median papilla (Pleijel & Dales, 1991; Alós, 2004).

***Phyllodoce lineata* (Claparède, 1870)**

Anaitides lineata Claparède, 1870 p. 94, pl. IX, fig. 4.
Phyllodoce callirhynchus Michaelsen, 1897 p. 33 pl. I, figs. 14-15.
Phyllodoce papulosa Saint-Joseph, 1898 p. 320, pl. XVIII, figs. 117-121.
Phyllodoce lineata Fauvel, 1923 p. 147, fig. 51; Alós, 2004 p. 156, fig. 52; Pleijel and Dales, 1991 p. 84, fig. 21.

Material examined. Atlantic Ocean. Bay of Biscay: St. Nazaire Canyon, St M84-5_649, 1103 m, 1 incompl. spm (cf.); St M84-5_651, 982 m, 1 incompl. spm (cf.); **Pagès**, St M84-5_600, 666 m, 1 spm; St M84-5_602, 594 m, 1 spm. **Gulf of Cadiz (CC): Pen Duick Escarpment**, St 64PE268_46, ~720 m, 1 incompl. spm (cf.); **Mound B,** St 64PE268_11A, 489 m, 1 incompl. spm (cf.); St 64PE268_13B, 493 m, 1 incompl. spm (cf.); **Gulf of Cadiz (MV): Al Idrisi MV,** St 64PE253_46B, 227 m, 1 incompl. spm; **Gemini MV,** St 64PE268_19, 430 m, 2 incompl. spms (cf.); **Anastasia Area,** St 64PE284_12705, 525 m, 1 incompl. spm (cf.); St 64PE284_12706, 702 m, 1 incompl. spm (cf.).

Brief description. Prostomium pentagonal with short antennae and palps and dark pigmentation above the eyes. Eyes medium sized. Pharyngeal proximal part with 25-30 rows of about fifteen papillae each. First segment not visible dorsally. Dorsum with dark pigmentation laterally, and centered on pseudosegmental areas forming a distinct median line. Tentacular cirri cylindrical, long. Parapodia uniramous. Dorsal cirri oblong-cordiform to rectangular. Acicular lobes with upper lip slightly longer than ventral one. Ventral cirri pointed, slightly longer than acicular lobes. Chaetae present from segment 3 (Pleijel & Dales, 1991; Alós, 2004).

Habitat. Muddy bottoms, until 900 m depth (Pleijel & Dales, 1991; Alós, 2004).

Distribution. Northeast Atlantic (from North Sea to Gibraltar strait; Mediterranean and Adriatic Sea) (Pleijel & Dales, 1991; Alós, 2004).

Remarks. A total of 12 specimens were examined from Bay of Biscay and Gulf of Cadiz areas. The majority of the specimens are very small, the pharynx is not everted and lacks dorsal cirri. Therefore, the diagnostic characteristics of the species were only fully confirmed with certainty in a few specimens. Further confirmation of the remaining specimens can only be possible with molecular analyses. The deepest location where *P. lineata* was found in the studied areas was in the St. Nazaire canyon, at 1103

m depth. However, the specimen could not be accurately identified and thus the given bathymetric distribution should be maintained (900 m, Alós, 2004).

Phyllodoce madeirensis Langerhans, 1880

Phylldoce (Anaitides) madeirensis Langerhans, 1880 p. 33: 307, fig. 48.
Phyllodoce madeirensis Fauvel, 1914 p. 111, pl. VI, figs. 5-13; 1919 p. 361, fig. 2; Rioja 1918 p. 30, fig. 7; Fauvel, 1923 p. 150, fig. 53-d; Alós, 2004 p. 147, fig. 48.
Phyllodoce sanctaevicentis McIntosh, 1885 p. 166.
Phyllodoce (Anaitides) africana Augener, 1918 p. 171, fig. 5, 49-51.

Material examined: Atlantic Ocean. Bay of Biscay: St. Nazaire Canyon, St M84-5_643, 825 m, 7 spms; St M84-5_644, 825 m, 4 spms (cf.); 15-06-2011, St M84-5_649, 1105 m, 1 spm (cf.); St M84-5_651, 982 m, 1 spm (cf.); St M84-5_653, 753 m, 1 spm; St M84-5_687, 537 m 3 spms (2 cf.); St M84-5_688, 667 m, 2 spms; St M84-5_689, 752 m, 1 spm (cf.); St M84-5_690, 755 m, 2 spms (1 cf.); **Cap Breton**, 12-06-2011, St M84-5_633, 221 m, 3 spms; St M84-5_677, 214 m, 5 incompl. spms; St M84-5_678, 215 m, 10 spms; St M84-5_679, 216 m, 1 spm; **Pagès Area**, St M84-5_619, 813 m, 1 compl. spm. **W Iberian Margin, Fontanelas**, St TTR17-2_AT692, 1230 m, 1 spm; **Gorringe Bank: Gettysburg Seamount**, St NA017_002, 2285 m, 1 incompl spm; St NA017_018, 1296 m, 1 incompl. spm (cf.); St NA017_046, 385 m, 1 incompl. spm. **Gulf of Cadiz (CC): Guadalquivir Ridge**, St TTR11_AT339, 1021-1086 m, 1 spm; **Formosa Ridge**, St TTR12_AT388, 1079 m, 10 spms (cf.); **W of Gibraltar Strait**, St TTR14_AT550, 368-392 m, 5 incompl. spms; St TTR14_AT552, 428 m, 2 incompl. spms; **Moroccan Margin**, St TTR17-2_AT654, 395 m, 1 incompl. spm (cf.); **Pen Duick Escarpment**, St 64PE237_16A, 660 m, 1 incompl. spm; St 64PE237_30A, 556 m, 1 spm (cf.); St 64PE237_31, 559 m, 1 spm; St 64PE268_39, 441 m, 1 incompl. spm; St 64PE268_40, 473 m, 1 spm; St 64PE268_46A, ~720 m, 1 incompl. spm; St 64PE268_50, 740 m, 1 spm (cf.); St 64PE268_55, ~700 m, 1 incompl. spm; **Mound B,** St 64PE268_24, 495 m, 1 incompl. spm; St 64PE268_26, 485 m, 1 incompl. spm (cf.); St 64PE268_27, 471 m, 1 incompl. spm; **Gulf of Cadiz (MV): Al Idrisi MV,** St 64PE253_46B, 227 m, 1 incompl. spm (cf.); **Mercator MV**, St TTR15_AT569, 358 m, 1 incompl. spm; St TTR15_AT575, 355 m, 2 incompl. spms; St TTR15_AT576, 428 m, 1 incompl. spm (cf.); St MSM01-3_237.2, 353 m, 1 incompl. spm; St MSM01-3_241, 353 m, 2 spms; St 64PE253_48, 376 m, 1 incompl. spm (cf.); St JC10_018-Rock1, 428 m, 1 incompl. spm; St JC10_018-Rock5, 373 m, 1 incompl. spm; St 64PE284_12750W, 354 m, 2 spms; **Fiuza MV**, St TTR14_AT566, 414 m, 3 incompl. spms (cf.); **Gemini MV**, St 64PE253_08, 444 m, 2 incompl. spms (cf.); St 64PE253_10, 432 m, 1 incompl. spm (cf.); St 64PE253_11, 438 m, 1 incompl. spm (cf.); St 64PE253_18, 608 m, 1 spm; **Kidd MV**, St TTR14_AT559, 552 m, 3 incompl. spms (1 cf.); St TTR14_AT561, 526 m, 1 incompl. spm (cf.); **Anastasia Area**, St 64PE284_12706, 702 m, 1 incompl. spm; **Lazarillo MV**, St 64PE237_20, 516 m, 1 spm (cf.); St 64PE237_21, 498 m, 1 incompl. spm; St 64PE253_38B, 497 m, 1 incompl. spm; **Meknès MV**, St MSM01-3_319, 695 m, 1 incompl. spm (cf.); St MSM01-3_321, 732 m, 1 incompl. spm (cf.); St MSM01-3_335, 703 m, 4 incompl. spms; St 64PE284_12750W, 698 m, 1 spm.
Mediterranean Sea. Alboran Sea (CS): Dakha MV, St TTR17-1_MS413, 377 m, 1 spm; **Alboran Sea (CC): Mellilla Coral Mound Field**, St TTR17-1_MS392, 246 m, 1 compl. spm.

Brief description. Prostomium long and pentagonal, with conical, short antennae and palps. Eyes large. Distinct nuchal papilla near the posterior border. Pharyngeal proximal part with six rows of 6-12 papillae on each side and a single median-dorsal row of 4-6 papillae. First segment partially covered

anteriorly by prostomium. Tentacular cirri cylindrical. Parapodia uniramous. Dorsal cirri lanceolate, leaf-like. Ventral cirri oval, lanceolate, slightly longer than acicular lobes. Chaetae present from fourth segment. Compound chaetae spinigerous with rostrum of shaft finely spinulated. Pygidium with a pair of cylindrical cirri (Alós, 2004; Oliveira, 2013).

Habitat. Almost all kinds of substrates (soft and hard), up to 950 m depth (Alós, 2004).

Distribution. In temperate and tropical waters around the world. Atlantic Ocean (from North Carolina to Brazil; from France to South Africa; Mediterranean Sea), Indian Ocean (from India to Madagascar), Pacific Ocean (from Japan to Australia; from California to Galápagos Islands) (Alós, 2004; Oliveira 2013).

Remarks. A total of 113 specimens of *Phyllodoce madeirensis* were examined within this study, although for some of them (aproximattely 40 smaller, incomplete or damaged) the characteristics of the species could not be fully confirmed. The single median row of papillae in the proximal part of the pharynx, one of the diagnostic features of this species, could only be examined with certainty on the larger specimens. Molecular analyses done, within the framework of a parallel study, to four of the specimens studied herein (three from G. Cadiz, one from Alboran Sea) indicated that the specimen from Alboran Sea was different from the ones from the Gulf of Cadiz. Morphologically all these specimens are very similar and no reasons were found to be considered as different species. However, further research is needed in order to clarify this situation. *Phyllodoce madeirensis* was originally described from Madeira Island and is known to occur in temperate and tropical waters around the world, at sublittoral depths until 950 m (Alós, 2004; Oliveira, 2013). The registers herein further extend the bathymetric distribution until 2285 m depth. This wide range of geographic and bathymetric distribution should be considered with caution and also need further investigation.

- Genus ***Protomystides*** Czerniavsky, 1882

Protomystidella Hartmann-Schröder, 1983 p. 125.
Pseudeulalia Eliason, 1962 p. 232-234.

Type Species. *Mystides bidentata* Langerhans, 1880.

Brief description. Prostomium rectangular, with a pair of antennae and palps. Eyes may not be visible. Pharynx with conical papillae. First segment completely visible dorsally. Four pairs of cylindrical or

flattened and short tentacular cirri. Parapodia uniramous. Dorsal and ventral cirri oval, longer than wide. Chaetae present from second or third segment. Compound spinigerous chaetae. Pygidium with a pair of cylindrical or plane cirri and a median papilla (Ushakov, 1972; Day, 1967; Alós, 2004).

***Protomystides exigua* (Eliason, 1962)**

Pseudoeulalia exigua Eilason, 1962 p. 232, fig. 7; Pleijel and Dales, 1991 p. 70, fig. 14.

Material examined. Atlantic Ocean. Bay of Biscay: **Pagès Area**, St M84-5_600, 666 m, 1 incompl. spm. Horseshoe Continental Rise: **Abzu MV**, St M86-5_349, 4560 m 1 spm; St M86-5_369, 4550 m, 1 spm.

Brief description. Prostomium rounded. Eyes not visible. Pharynx unknown. Tentacular cirri long and slender. Dorsal cirri of median segments oval, thick. Ventral cirri similar to dorsal ones but smaller. Chaetae present from second segment. Compound chaetae spinigerous with very long and slender blades and rostrum of shaft with few equally sized teeth. Pygidium with a pair of cirri similar to dorsal cirri. (Pleijel & Dales, 1991).

Habitat. Muddy bottoms, from 75 to 4560 m (Pleijel & Dales, 1991; present study).

Distribution. Northeast Atlantic (Skagerrak, Norwegian Trough) (Pleijel & Dales, 1991); Bay of Biscay and Gulf of Cadiz (present study).

Remarks. This study extends the geographic and bathymetric distribution of this species to the Gulf of Cadiz and from 460 m (Pleijel & Dales, 1991) to 4560 m depth.

5. Final remarks on ecology and distribution

5.1. Species richness

Aphroditiformia, the most speciose suborder for the majority of the areas studied (Figure 26), was represented by a total of 24 species, the majority of which belong to the family Polynoidae (16 species). Polynoid species were found mainly on carbonate crusts and cold-water corals, with the presence of species typically or often occurring as commensal with gorgonian and stylasterid corals (e.g. *Gorgoniapolynoe caeciliae*; *Leucia violacea*; *Harmothoe aspera*; *H. fraserthomsoni*). The suborders Glyceriformia and Phyllodociformia were represented by nine and ten species, respectively.

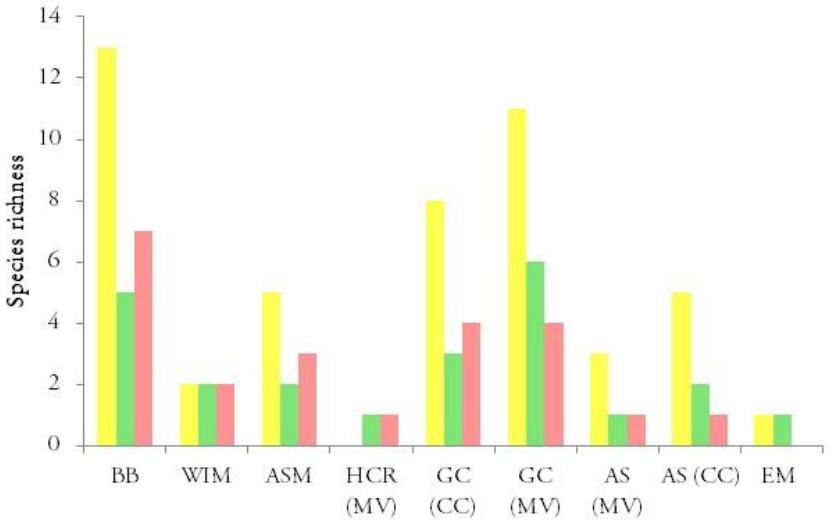

Figure 26. Polychaete species richness of Aphroditiformia (yellow), Glyceriformia (green) and Phyllodociformia (rose) within the studied areas. Legend: BB- Bay of Biscay; WIM- W Iberian Margin; ASM- Atlantic Seamounts; HCR - Horseshoe Continental Rise; GC - Gulf of Cadiz; AS- Alboran Sea; EM- Eastern Mediterranean Sea. MV – mud volcanoes; CC – carbonate crusts and cold-water corals.

A total of 209 stations were sampled in all the studied areas, the majority of which located in the Gulf of Cadiz (149 stations – 84 on mud volcanoes and 65 on carbonate crust and cold-water coral areas). This high sampling effort, in the Gulf of Cadiz yielded a relatively lower number of Phyllodocid species (21 species in mud volcanoes and 15 in carbonate crusts and coral areas) when compared to the Bay of Biscay with 25 species found in much lower sampling effort: 17 stations sampled from two coral facies (*Lophelia* and *Madrepora* framework in St Nazaire Canyon and *Dendrophyllium cornigera* in Cap Breton Canyon). Mud volcano samples yielded only 2 species in the Horseshoe Continental Rise (6 stations) and five species in the Alboran Sea (5 stations). Furthermore, eight species were collected in

the Melilla Coral Mound field (4 stations) while 10 species were collected mostly from hard substrate settings in Atlantic seamounts (15 species in 10 stations) (Figure 26 and Annex I). The lowest number of species (2 species in 13 stations) was collected in the East Mediterranean, an area previously known to be highly oligotrophic and poor in benthic fauna (Kröncke *et al.*, 2003).

5.2. Bathymetric distribution

The observed distribution of most Aphroditiformia species is in accordance with their previously known depth range (Figure 27). The depth range of six species was herein extended: *Fimbriosthenelais zetlandica* (down to 1128 m), *Gorgoniapolynoe caeciliae* (from 385 to 2285 m), *Leanira hystricis* (down to 3902 m), *Lepidasthenia brunnea* (down to 246 m), *Leucia nivea* (down to 820 m) and *Pholoides dorsipapillatus* (down to 2285 m).

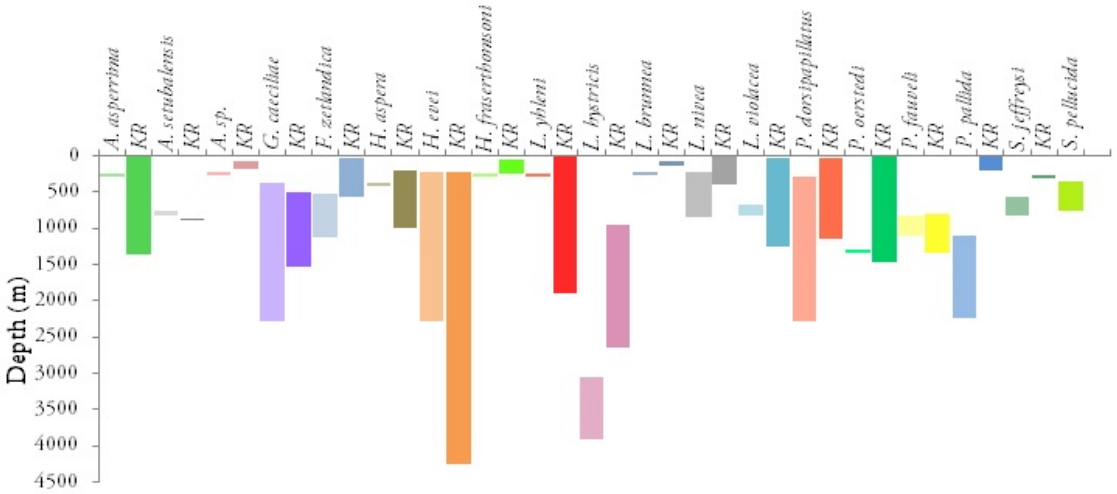

Figure 27. Bathymetric distribution of the recorded species of the suborder Aphroditiformia; KR- Known depth range.

Among the examined Glyceriformia, three species occurred at greater depths than previously known (Figure 28): *Glycera noelae, Glycera tesselata* and *Glycerella magellanica* extend their bathymetric range to 4864, 3265 and 2285 m, respectively.

In the case of Phyllodociformia bathymetric ranges were also extended for three species (Figure 29): *Eumida* cf. *longicirrata*, *Phyllodoce madeirensis* and *Protomystides exigua* (3060, 2285 and 4560 m, respectively).

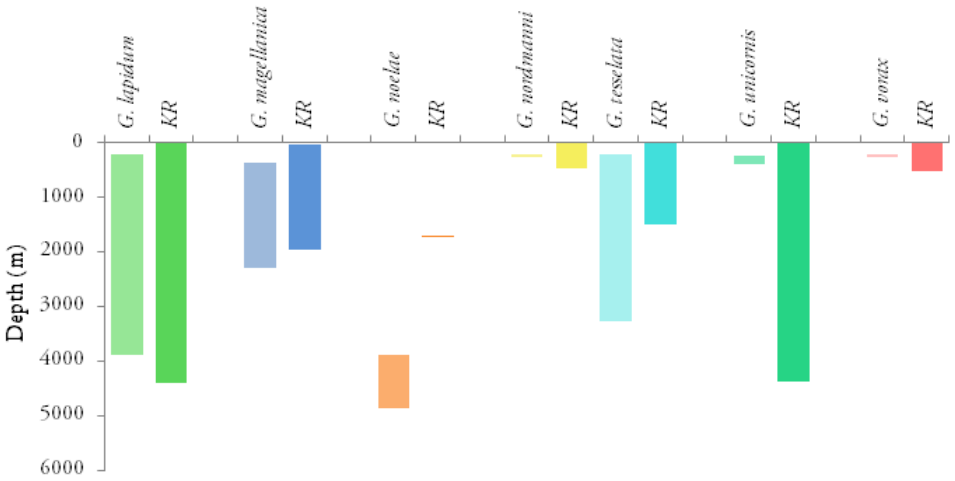

Figure 28. Bathymetric distribution of the recorded species of the suborder Glyceriformia. KR- Known depth range.

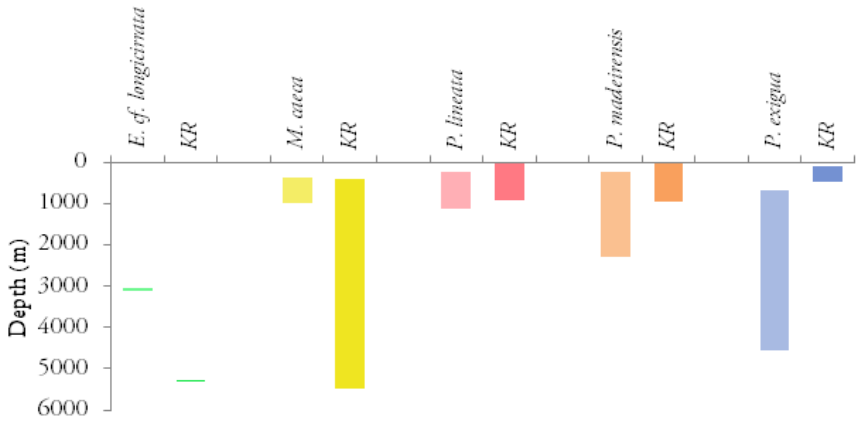

Figure 29. Bathymetric distribution of the recorded species of the suborder Phyllodociformia. KR- Known depth range.

5.3. Habitat and geographic distribution

Some specimens examined during this study were damaged which impaired their identification to species level (*Anotochaetonoe* sp., cf. *Robertianella* sp., *Harmothoe* sp., *Herdmanella* sp., *Macellicephala* sp., *Polynoe* sp., cf. *Progoniada* sp., *Ophiogoniada* sp., cf. *Eteone* sp., cf. *Paranaitis* sp., *Eulalia* sp., *Nereiphylla* sp. and *Notophyllum* sp.). There were also many other specimens in good or relatively good condition that remain undetermined in all suborders. Those specimens require further examination in

order to determine their identity. Because the deep sea biodiversity is still poorly known, there are undiscovered habitats and certainly many undescribed species and therefore, it is likely that some of those undetermined specimens may represent new species to science.

Among the identified species, *Panthalis oerstedi*, *Harmothoe aspera*, *Harmothoe fraserthomsoni*, *Labioleanira yhleni*, *Goniada vorax* and *Eumida longicirrata* are singletons (represented by only one specimen) and therefore little can be inferred regarding their distribution.

In other cases, species seem to be typical from some specific habitats: *Gorgoniapolynoe caeciliae*, was only found in the Gorringe Bank in close association with soft-corals, *Pholoe pallida*, *Leanira hystricis* and *Glycera noelae* were found in the mud volcanoes from Gulf of Cadiz and Horseshoe Continental Rise, whilst *Almaniella setubalensis* and *Pholoe fauveli* (St. Nazaire Canyon), and *Leucia nivea* and *Glycinde nordmanni* (Cap Breton) were only found in coral habitats in submarine canyon settings in the Bay of Biscay.

Some species have wider geographic ranges but occur mainly in association with cold-water coral settings and/or hard substrate either on seamounts, carbonate mounds or carbonate crusts: these are the cases of *Glycerella magellanica* (Gettysburg Seamount, and Gulf of Cadiz), *Mystides caeca* (Bay of Biscay and Atlantis Seamount), *Phyllodoce lineata* (Bay of Biscay and Gulf of Cadiz), *Lepidasthenia brunnea* (Bay of Biscay and Alboran Sea).

There were also several species found both in coral and cold seep settings with a relatively wide geographical range (e.g. *Leucia violacea*, *Fimbriosthenelais zetlandica, Sthenelais jeffreysi, Glycera tesselata, Glycera unicornis*, *Protomystides exigua*). However, the most frequent species, occurring practically in all study areas, were *Harmothoe evei*, *Subadyte pellucida*, *Pholoides dorsipapillatus*, *Glycera lapidum* and *Phyllodoce madeirensis*

In this study, the known geographic distribution is extended for six Aphroditiformia species (*Almaniella setubalensis*, *Harmothoe evei*, *Leucia violacea*, *Leanira hystricis*, *Pholoides dorsipapillatus* and *Sthenelais jeffreysi*), one Glyceriformia species (*Glycera noelae*) and one Phyllodociformia species (*Protomystides exigua*) (Figure 30). The majority of those species was previously recorded from northern areas in the Atlantic Ocean (at the United Kingdom and higher latitudes) and is now reported also from the Gulf of Cadiz or the Mediterranean Sea. Also, the species *Almaniella setubalensis* that was only known from its type locality off Setubal (Portugal) is herein reported in the Bay of Biscay, and *Glycera*

noelae, previously only known from the east Mediterranean Sea is herein reported from some of the deeper mud volcanoes the Gulf of Cadiz.

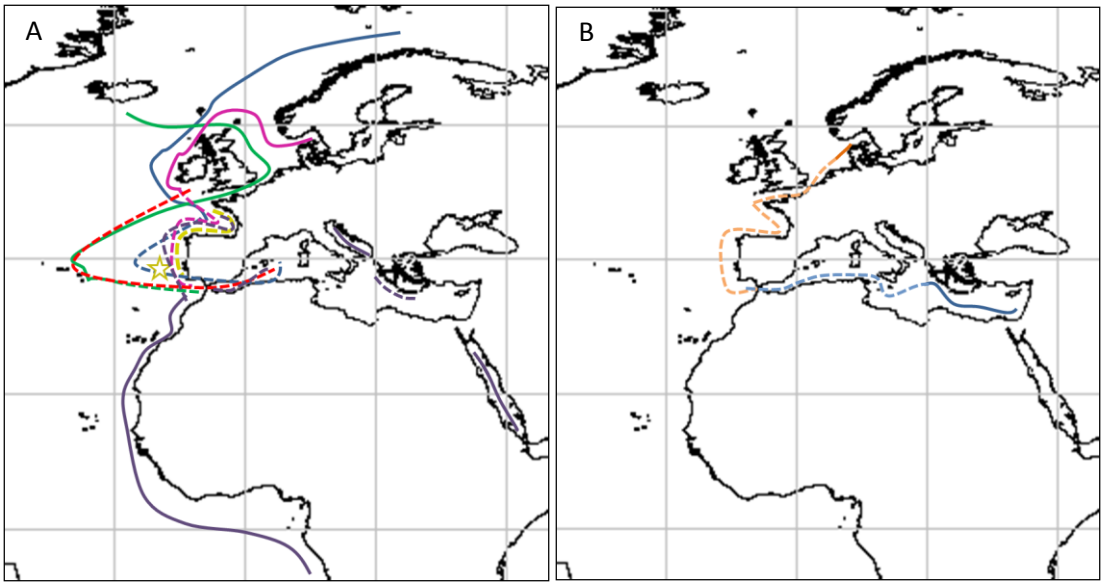

Figure 30. Geographic extension of the examined species. A. Blue - *Leucia violacea*; Green - *Leanira hystricis*; Purple - *Pholoides dorsipapillatus*; Pink - *Sthenelais jeffreysi*; Red - *Harmothoe evei*; Yellow - *Almaniella Setubalensis*. B. Blue - *Glycera noelae*; Orange -*Protomystides exigua*. Bold lines and star - known geographical range; Dashed lines - geographical extension.

Several other species, such as *Glycera lapidum*, *Glycera tesselata*, *Glycera unicornis*, *Glycerella magellanica, Mystides caeca* and *Phyllodoce madeirensis*, present a very wide geographic distribution that should be more carefully investigated in terms of an eventual genetic divergence between populations.

One major constraint to deep-sea benthic organisms is food limitation (Smith *et al.* 2006) because only a small portion of the surface productivity reaches the seafloor. The observed variations in species richness of the different study areas is partially due to differences in sampling effort (and depth ranges covered) but the trophic ecology of the species is determinant for their distribution and therefore many species may be linked to habitats with complex trophic interactions (e.g. coral stands) or alternative food sources (e.g. cold seeps).

Despite the low knowledge of evolution in the deep-sea, it can also be established that the contemporary biogeographic patterns of deep-sea organisms are a result of geographic differences in the dispersal, spread of taxa and radiation among others (Stuart & Rex, 1994; Allen & Sanders, 1996;

Wilson, 1998). Further studies are needed to understand the observed distributions of the examined species.

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ANNEX I

List of samples taken for Phyllodocida studies. Code of Gear ccording to Table 3 in "Methodology".

Structure	Station code	Gear	Date dd.mm.yy	Latitude (N)	Longitude (W)	Depth (m)	Taxa	Observations
Bay of Biscay								
St Nazaire C	M84-5_643	Gr	14.06.11	46º13.92'N	04º19.56'W	825	*Harmothoe evei; Leucia nivea; Leucia violaeca; Fimbriosthenelais zetlandica; Pholoides dorsipapillatus; Sthenelais jeffreysi; Glycera lapidum; Phyllodoce madeirensis*	*Madrepora* / *Lophelia* framework
	M84-5_644	Gr	14.06.11	46º13.92'N	04º19.56'W	825	*Pholoe* cf. *fauveli; Almaniella setubalensis; Harmothoe evei; Leucia violaeca; Fimbriosthenelais* cf. *zetlandica; Pholoides dorsipapillatus; Phyllodoce* cf. *madeirensis*	*Madrepora* / *Lophelia* framework
	M84-5_649	UB	15.06.11	46º13.98'N	04º20.52'W	1105	*Pholoe fauveli; Pholoides dorsipapillatus; Glycera lapidum; Eulalia* sp.; cf. *Eteone* sp.*; Phyllodoce* cf. *lineata*; *Phyllodoce* cf. *madeirensis*	*Madrepora* / *Lophelia* framework
	M84-5_651	UB	15.06.11	46º14.10'N	04º20.28'W	982	*Pholoe fauveli; Pholoides dorsipapillatus; Glycera lapidum; Mystides caeca; Phyllodoce* cf. *lineata*; *Phyllodoce* cf. *madeirensis*	*Madrepora* / *Lophelia* framework
	M84-5_653	UB	15.06.11	46º14.22'N	04º19.56'W	753	*Almaniella setubalensis; Harmothoe evei; Leucia violaeca; Pholoides dorsipapillatus; Glycera lapidum; Phyllodoce madeirensis*	*Madrepora* / *Lophelia* framework
	M84-5_687	Gr	19.06.11	46º14.28'N	04º18.60'W	537	*Harmothoe evei; Leucia nivea; Phyllodoce madeirensis*	*Madrepora* / *Lophelia* framework
	M84-5_688	Gr	19.06.11	46º14.16'N	04º19.26'W	667	*Harmothoe* sp.; *Harmothoe evei;* cf. *Herdmanella* sp.; *Leucia nivea; Leucia violaeca; Fimbriosthenelais* cf. *zetlandica; Pholoides dorsipapillatus; Glycera lapidum; Phyllodoce madeirensis*	*Madrepora* / *Lophelia* framework
	M84-5_689	Gr	19.06.11	46º14.22'N	4 º 19.56'W	752	*Almaniella setubalensis; Harmothoe evei;* cf. *Herdmanella* sp.; *Leucia nivea; Pholoides*	*Madrepora* / *Lophelia* framework

	M84-5_690	Gr	19.06.11	46º14.22'N	40º19.56'W	755	*dorsipapillatus; Phyllodoce* cf. *madeirensis Almaniella setubalensis; Harmothoe evei; Leucia nivea; Leucia violaeca; Pholoides dorsipapillatus; Phyllodoce madeirensis*	*Madrepora* / *Lophelia* framework
Cap Breton	M84-5_633	Gr	12.06.11	43º31.74'N	02˚45.60'W	221	*Acanthicolepis asperrima; Harmothoe evei; Harmothoe fraserthomsoni; Lepidasthenia* cf. *brunnea; Leucia nivea; Glycera lapidum; Glycera tesselata; Paranaitis* sp.; *Phyllodoce madeirensis*	Head of canyon tributary; boulders; *Dendrophyllia cornigera* facies
	M84-5_677	Gr	17.06.11	43º31.68'N	02˚45.48'W	214	*Glycera lapidum; Glycinde nordmanni; Eulalia* sp.; *Phyllodoce madeirensis*	Head of canyon tributary; boulders; *Dendrophyllia cornigera* facies
	M84-5_678	Gr	17.06.11	43º31.68'N	02˚45.48'W	215	*Harmothoe* sp.; *Lepidasthenia* cf. *brunnea; Leucia nivea; Glycera lapidum; Glycera tesselata; Glycinde nordmanni; Goniada vorax;* cf. *Progoniada* sp.*; Phyllodoce madeirensis*	Head of canyon tributary; boulders; *Dendrophyllia cornigera* facies
	M84-5_679	Gr	17.06.11	43º31.68'N	02º45.48'W	216	*Harmothoe evei; Lepidasthenia* cf. *brunnea; Glycera* cf. *tesselata; Glycinde nordmanni; Phyllodoce madeirensis*	Head of canyon tributary; boulders; *Dendrophyllia cornigera* facies
Pagès Area	M84-5_600	UB	07.06.11	44º58.20´N	05º43.50'W	666	*Phyllodoce lineata*; *Protomystides exigua*	Hemipelagic sediments, sea-feather facies
	M84-5_602	UB	07.06.11	44º58.32'N	05º43.26'W	594	*Eulalia* sp.; *Phyllodoce lineata*	Hemipelagic sediments, *Callogorgia* facies
	M84-5_619	Gr	09.06.11	44º03.30'N	05º40.98'W	813	*Phyllodoce madeirensis*	Coral rubble, base of rocky outcrop, N of Pagès Escarpment
W Iberian Margin								
Fontanelas	TTR17-2_AT689	D	03.07.08	39°05.022'N	10°33.247'W	1194	*Pholoides dorsipapillatus; Glycerella magellanica;*	Fossilised corals and carbonates
	TTR17-2_AT690	D	03.07.08	39˚04.775'N	10˚34.114'W	1340	*Pholoides dorsipapillatus; Eulalia* sp;	Fossilised corals and carbonates
	TTR17-2_AT691	D	03.07.08	39°05.220'N	10°34.60'W	1308	*Subadyte* cf. *pellucida; Pholoides*	Fossilised corals and

							dorsipapillatus; Glycera tesselata	carbonates
	TTR17-2_AT692	D	03.07.08	39°04.991'N	10°33.112'W	1230	*Phyllodoce* cf. *madeirensis*	Fossilised corals and carbonates
	TTR17-2_AT693	D	03.07.08	39°05.082'N	10°33.483'W	1110	*Glycera magellanica*	Fossilised corals and carbonates
Atlantic Seamounts								
Atlantis	TTR12_AT421	D	24.08.02	34°00.355'N	30°10.350'W	614	*Pholoides dorsipapillatus*	Carbonate crusts and basalts
				34°00.460'N	30°10.360'W	555		
	TTR12_AT422	Gr	24.08.02	34°05.831'N	30°11.719'W	375	*Harmothoe evei Mystides caeca*	Carbonate crusts and basalts
Nameless	TTR11_353	Gr	01.09.01	35°18.75'N	14°49.81'W	1853	*Pholoides dorsipapillatus*	Polimetalic nodules
Gettysburg	NA017_002	ROV	10.10.11	36°26.390'N	11°21.446'W	2285	*Gorgoniapolynoe caeciliae; Harmothoe* cf. *evei; Pholoides dorsipapillatus; Glycera tesselata; Glycerella magellanica; Eulalia* sp.; *Phyllodoce madeirensis*	SW Flank; coral sample
	NA017_018	ROV	16.10.11	36°38.571'N	11°36.191'W	1296	*Phyllodoce* cf. *madeirensis*	NW Flank; sunken wood
	NA017_034	ROV	15.10.11	36°34.611'N	11°39.169'W	1140	*Glycerella magellanica*	NW Flank, sponge sample
	NA017_045	ROV	16.10.11	36°34.769'N	11°37.775'W	614	*Pholoides dorsipapillatus*	NW Flank; epifauna on rock -suction
	NA017_046	ROV	16.10.11	36°34.315'N	11°36.892'W	385	*Gorgoniapolynoe caeciliae; Harmothoe evei; Phyllodoce madeirensis;*	NW Flank; sunken wood
Ormonde	NA017_H1204	ROV	17.10.11	36°37.716'N	11°01.796'W	111-	*Macellicephala* sp.; *Polynoe* sp.; *Pholoides dorsipapillatus*	Sample taken from ROV drawer, depth unknown
			18.10.11	36°41.293'N	11°14.455'W	2033		
Coral Patch	64PE284_12767	ROV	07.03.08	34°56.71'N	11°58.44'W	761	*Glycerella magellanica*	Scoop of coral rubble
Horseshoe Continental Rise –Mud Volcanoes								
M. Ivanov	M86-5_348	UB	05.03.12	35°44.410'N	10°12.179'W	4497	*Glycera noelae*	Crater; mud breccia
	M86-5_407	UB	14.03.12	35°44.342'N	10°12.056'W	4507	*Glycera noelae*	Crater; mud breccia
Tiamat	M86-5_339	UB	03.03.12	35°45.712'N	10°21.248'W	4551	*Glycera* cf. *noelae*	Crater; mud breccia
Abzu	M86-5_349	UB	05.03.12	35°45.046'N	10°19.026'W	4560	*Protomystides exigua*	Crater; mud breccias
	M86-5_369	UB	08.03.12	35°45.045'N	10°19.018'W	4550	*Protomystides exigua*	Crater; mud breccia
Site2	M86-5_366	UB	07.03.12	35°47.265'N	10°38.499'W	4864	*Glycera* cf. *noelae*	Near SWIM fault

Gulf of Cadiz - Carbonate crusts and Cold-Water Corals								
Cadiz Channel	TTR15_AT599	D	03.08.05	36º06.538'N	07º53.942'W	1418	*Pholoides dorsipapillatus*	Carbonate chimneys
				36º06.379'N	07º53.564'W	1275		
Guadalquivir Rg.	TTR11_AT339	D	26.08.01	36º07.765'N	07º46.461'W	1086	*Harmothoe evei; Pholoides dorsipapillatus; Phyllodoce madeirensis*	Carbonate chimneys
				36º07.591'N	07º46.587'W	1021		
Formosa Rg.	TTR12_AT388	Gr	08.07.02	36º10.263'N	07º43.819'W	1079	*Harmothoe evei; Subadyte* cf. *pellucida; Pholoides dorsipapillatus; Glycerella magellanica; Notophyllum* sp.; *Phyllodoce* cf. *madeirensis*	Carbonate chimneys
	TTR12_AT389	D	08.07.02	36º10.123'N	07º44.121'W	1068		Carbonate chimneys
Ibérico	TTR11_AT335	D	25.08.01	36º07.159'N	07º41.129'W	1037	*Pholoides dorsipapillatus*	Carbonate chimneys
				36º07.405'N	07º41.198'W	905		
W of Gibraltar Str	TTR14_AT550	D	07.08.04	35º42.105'N	06º30.196'W	368	*Pholoides dorsipapillatus; Phyllodoce madeirensis*	Carbonate chimneys
				35º42.257'N	06º30.000'W	392		
	TTR14_AT551	D	07.08.04	35º42.597'N	06º30.505'W	445	*Harmothoe evei; Subadyte pellucida; Pholoides dorsipapillatus*	Carbonate chimneys
				35º42.769'N	06º30.305'W	393		
	TTR14_AT552	Gr	07.08.04	35º42.816'n	06º30.234'W	428	*Harmothoe* cf. *evei; Subadyte pellucida; Pholoides dorsipapillatus; Phyllodoce madeirensis*	Carbonate chimneys in brown maërl
Moroccan Margin	TTR17-2_AT650	Gr	24.06.08	35˚16.154'N	06˚33.431'W	326	*Harmothoe* cf. *evei; Glycera lapidum*	Coral debris
	TTR17-2_AT654	Gr	25.06.08	35˚18.948'N	06˚37.275'W	395	*Glycera lapidum; Phyllodoce* cf. *madeirensis*	Coral debris
Vernadsky Rg.	TTR15_AT574	D	26.07.05	35º26.150'N	06º46.915'W	512	*Pholoides dorsipapillatus*	Carbonate crusts and chimneys
				35º25.982'N	.06º46.661'W	508		
	64PE284_12758	ROV	04.03.08	35°26.33'N	06°47.39'W	561	*Glycera lapidum*	Coral sample
	64PE284_12759	NB	04.03.08	35°26.57'N	06°46.78'W	524	*Fimbriosthenelais zetlandica; Pholoides dorsipapillatus*	Sediment with coral fragments
Pen Duick Esc.	TTR12_AT406	Gr	15.07.02	35º18.148'N	06º47.666'W	550	*Harmothoe evei; Subadyte pellucida; Pholoides dorsipapillatus; Glycerella magellanica; Nereyphilla* sp.	Coral framework
	TTR12_AT407	Gr	15.07.02	35º17.695'N	06º47.082'W	560	*Harmothoe evei; Subadyte pellucida; Pholoides dorsipapillatus; Sthenelais jeffreysi*	Coral framework
	64PE237_05C	NB	21.05.05	35º17.56´N	06º47.15'W	533	*Glycera lapidum*	Sediment with coral frg
	64PE237_07	NB	24.05.05	35º18.01'N	06º47.73'W	570	*Harmothoe* cf. *evei; Glycera lapidum*	Sediment with coral frg
	64PE237_16A	NB	26.05.05	35º18.31'N	06º48.21'W	660	*Pholoides dorsipapillatus; Phyllodoce madeirensis*	Coral framework/rubble

64PE237_30A	NB	01.06.05	35°18.76'N	06°47.86'W	556	*Phyllodoce* cf. *madeirensis*	Sediment with coral fragments
64PE237_31	NB	01.06.05	35°18.79'N	06°47.93'W	559	*Glycera lapidum; Phyllodoce* cf. *madeirensis*	Coral framework/rubble
TTR16_AT600	Gr	28.05.06	35°18.779'N	06°48.453'W	610	cf. *Robertianella* sp.; *Subadyte pellucida*; *Fimbriosthenelais zetlandica; Pholoides dorsipapillatus; Sthenelais jeffreysi*	Mud breccia covered by coral debris and carbonate crusts
TTR16_AT602	Gr	28.05.06	35°17.693'	06°47.089'	556	*Glycera lapidum*	Hemipelagic sediments, shell ash cemented by carbonate
64PE253_19	NB	09.10.06	35°11.31'N	07°04.30'W	908	cf. *Robertianella* sp.	Sediment with coral fragments; off mound
64PE253_23	NB	10.10.06	35°19.02'N	06°48.22'W	557	*Fimbriosthenelais zetlandica; Pholoides dorsipapillatus; Glycera lapidum*	Coral framework/rubble
64PE253_24	NB	10.10.06	35°19.02'N	06°48.34'W	571	*Pholoides dorsipapillatus*	Coral framework/rubble
64PE253_25	NB	10.10.06	35°19.00'N	06°48.56'W	648	*Pholoides dorsipapillatus*	Sediment with coral fragments
64PE253_26	NB	10.10.06	35°19.00'N	06°48.65'W	628	*Glycera lapidum*	Sediment with coral fragments
64PE253_33	NB	11.10.06	35°18.93'N	06°47.59'W	542	*Harmothoe* cf. *evei*	Sediment with coral fragments
64PE253_40A	NB	13.10.06	35°18.91'N	06°47.03'W	560	*Pholoides dorsipapillatus; Glycera lapidum;*	Coral framework/rubble
64PE253_41	NB	13.10.06	35°18.91'N	06°48.18'W	568	*Glycera lapidum*	Coral framework/rubble
64PE253_42	NB	13.10.06	35°18.92'N	06°48.39'W	637	*Glycera lapidum*	Coral framework/rubble
64PE253_52	NB	15.10.06	35°18.43'N	06°48.23'W	622	*Glycera lapidum*	Coral framework
64PE253_53	NB	15.10.06	35°18.31'N	06°48.20'W	651	*Pholoides dorsipapillatus; Glycera lapidum;*	Coral framework
64PE253_54	NB	15.10.06	35°18.09'N	06°48.12'W	634	*Pholoides dorsipapillatus*	Coral framework
64PE253_59	NB	16.10.06	35°17.79'N	06°47.77'W	637	*Glycera lapidum*	Coral framework / rubble
64PE268_04	NB	01.05.07	35°14.00'N	06°46.04'W	597	*Glycera lapidum*	Hemipelagic sediment; mound
64PE268_05	NB	01.05.07	35°14.01'N	06°45.49'W	581	*Glycera lapidum*	Coral framework/rubble; off mound
64PE268_09	NB	02.05.07	35°14.04'N	06°46.94'W	428	*Glycera lapidum*	Coral framework/rubble
64PE268_20	NB	05.05.07	35°16.99'N	06°53.29'W	765	*Pholoides dorsipapillatus*	Hemipelagic sediment; off mound
64PE268_36	NB	11.05.07	34°59.89'N	06°44.61'W	465	*Glycera lapidum*	Hemipelagic sediment; mound

	64PE268_39	NB	11.05.07	35°00.23'N	06°44.89'W	441	*Glycera lapidum; Phyllodoce madeirensis*	Hemipelagic sediment; mound
	64PE268_40	NB	12.05.07	35°00.14'N	06°44.81'W	473	*Pholoides dorsipapillatus; Phyllodoce madeirensis;*	Undetermined; mound
	64PE268_41	NB	12.05.07	35°00.11'N	06°44.82'W	461	*Subadyte pellucida*	Undetermined; mound
	64PE268_42	NB	12.05.07	35°00.06'N	06°44.94'W	451	*Glycera lapidum*	Coral framework/rubble; mound
	64PE268_45	NB	13.05.07	35°01.01'N	06°59.06'W	**~800**	*Glycera lapidum*	Coral framework/rubble; mound
	64PE268_46	NB	13.05.07	35°01.18'N	06°58.89'W	**~720**	*Anotochaetonoe* sp.; *Pholoides dorsipapillatus; Glycera lapidum; Phyllodoce* cf. *lineata; Phyllodoce madeirensis*	Undetermined; mound
	64PE268_50	NB	14.05.07	35°01.339'N	06°58.899'W	**~740**	*Phyllodoce* cf. *madeirensis*	Coral framework/rubble; mound
	64PE268_51	NB	14.05.07	35°01.29'N	06°59.02'W	**~740**	*Glycera lapidum; Glycerella magellanica*	Undetermined; mound
	64PE268_53	NB	14.05.07	35°10.29'N	06°47.28'W	750	*Glycera lapidum*	Undetermined, mound
	64PE268_54	NB	15.05.07	35°10.23'N	06°47.30'W	750	*Glycera lapidum*	Undetermined, mound
	64PE268_55	NB	15.05.07	35°10.00'N	06°47.37'W	**~700**	*Phyllodoce madeirensis*	Undetermined, mound
Mound B	64PE268_11	NB	02.05.07	35°18.03'N	06°44.52'W	493	*Pholoides dorsipapillatus*	Undetermined; Mound B
	64PE268_11A	NB	02.05.07	35°17.99'N	06°44.48'W	489	*Pholoides dorsipapillatus; Glycera lapidum; Phyllodoce* cf. l*ineata;*	Coral framework/rubble; Mound B
	64PE268_12	NB	03.05.07	35°18.04'N	06°44.51'W	500	*Pholoides dorsipapillatus*	Undetermined; Mound B
	64PE268_13A	NB	03.05.07	35°18.00'N	06°44.49'W	475	*Pholoides dorsipapillatus; Glycera lapidum*	Coral framework/rubble; Mound B
	64PE268_13B	NB	03.05.07	35°18.01'N	06°44.49'W	493	*Harmothoe evei; Pholoides dorsipapillatus; Glycera lapidum; Phyllodoce* cf. *lineata*	Undetermined; Mound B
	64PE268_16	NB	04.05.07	35°17.61'N	06°43.61'W	473	*Harmothoe* cf. *evei; Subadyte pellucida; Pholoides dorsipapillatus*	Coral framework/rubble; Mound B
	64PE268_23A	NB	05.05.07	35°17.77'N	06°43.96'W	498	*Harmothoe* cf. *evei; Glycera lapidum*	Hemipelagic sediment; Mound B
	64PE268_24	NB	06.05.07	35°17.73'N	06°43.89'W	495	*Glycera lapidum; Phyllodoce madeirensis;*	Coral framework/rubble; Mound B
	64PE268_25	NB	06.05.07	35°17.70'N	06°43.80'W	490	*Glycera lapidum*	Coral framework/rubble; Mound B
	64PE268_26	NB	06.05.07	35°17.66'N	06°43.72'W	485	*Phyllodoce* cf. *madeirensis*	Sediment with coral fragments; Mound B

	64PE268_27	NB	06.05.07	35°17.63'N	06°43.64'W	471	*Harmothoe* cf. *evei; Pholoides dorsipapillatus; Glycera lapidum; Phyllodoce madeirensis*	Sediment with coral fragments; Mound B
Central CMP	64PE284_12729	NB	26.02.08	35°10.83'N	06°56.53'W	754	*Leucia violacea; Subadyte pellucida; Glycerella magellanica*	Coral framework/rubble
SE of Yuma CMP	64PE284_12721	NB	25.02.08	35°18.59'N	06°59.94'W	868	*Pholoides dorsipapillatus*	Sediment with coral fragments
	64PE284_12722	NB	25.02.08	35°18.63'N	07°00.99'W	907	*Harmothoe* sp.; *Pholoides dorsipapillatus*	Sediment with coral fragments
Meknès CMP	64PE284_12739	NB	28.02.08	35°00.01'N	07°04.47'W	736	*Subadyte pellucida; Pholoides dorsipapillatus;*	Coral framework/rubble
Gulf of Cadiz – Mud volcanoes								
Al Idrisi	64PE253_46A	NB	14.10.06	35°13.86'N	06°36.60'W	228	*Anotochaetonoe* sp.	Crater, coral fragments
	64PE253_46B	NB	14.10.06	35°13.85'N	06°36.59'W	227	*Glycera* cf. *lapidum; Glycera* cf. *unicornis; Phyllodoce* cf. *madeirensis; Phyllodoce lineata; Harmothoe* cf. *evei*	Crater, coral fragments
Mercator	TTR12_AT409	D	16.07.02	35°17.688'N 35°17.929'N	06°38.603'W 06°38.903'W	397 375	*Glycera unicornis*	Crater & rim, sandstones, siltstones
	TTR12_AT410	D	16.07.02	35°17.796'N 35°18.014'N	06°38.716'W 06°38.986'W	366- 392	*Glycera unicornis*	Crater & rim, sandstones, siltstones
	TTR15_AT569	Gr	25.07.05	35°17.917'N	06°38.717'	358	*Phyllodoce madeirensis*	Crater; mud breccia, near seep
	TTR15_AT575	UB	26.07.05	35°17.903'	06°38.715'	355	*Subadyte pellucida; Glycera lapidum; Glycera unicornis;* cf. *Eulalia* sp.; *Phyllodoce madeirensis*	Crater; mud breccia; near seep
	TTR15_AT576	UB	26.07.05	35°17.657'	06°39.129'	428	*Glycera lapidum; Phyllodoce* cf. *madeirensis*	Flank; mud breccia
	MSM01-3_237.2	MC	06.05.06	35°17.914'	06°38.687'	353	*Glycera lapidum;* ***Eulalia* sp.** *Phyllodoce madeirensis*	Crater; mud breccia, near seep
	MSM01-3_241	UB	06.05.06	35°17.918'N	06°38.717'	353	*Macellicephala* sp.; *Pholoides dorsipapillatus; Glycera lapidum;* ***Eulalia* sp.**; . *Phyllodoce madeirensis*	Crater; mud breccia, near seep; *Caryophyllia* facies
	MSM01-3_242	UB	06.05.06	35°17.870'N	06°38.810'	350	*Glycera lapidum*	Crater; mud breccia *Hyalinoecia* facies
	64PE253_48	NB	14.10.06	35°17.90'N	06°39.00'W	376	*Glycera lapidum; Phyllodoce* cf. *madeirensis*	Crater, coral fragments
	64PE253_49	NB	14.10.06	35°17.90'N	06°38.64'W	360	*Glycera lapidum*	Crater, coral fragments
	JC10_018-Rock1	ROV	18.05.07	35°18.755'N	06°37.422,W	428	*Phyllodoce madeirensis*	Flank, rock sample
	JC10_018-Rock2	ROV	18.05.07	35°18.823'N	06°37.377'W	432	*Harmothoe evei; Pholoides dorsipapillatus*	Flank, rock sample

	JC10_018-Rock5	ROV	18.05.07	35°18.825'N	06°37.154'W	373	*Harmothoe evei; Glycerella magellanica; Phyllodoce madeirensis*	Crater rim, rock sample
	JC10_018-Rock6	ROV	18.05.07	35°18.827'N	06°37.058'W	376	*Harmothoe evei*	Crater rim, rock sample
	JC10_018-Rock7	ROV	18.05.07	35°18.840'	06°37.040'	381	*Glycerella magellanica*	Crater rim, rock sample
	64PE284_12750W	CHE	02.03.08	35°17.916'N	06°38,709'W	354	*Harmothoe evei; Subadyte pellucida; Phyllodoce madeirensis*	Crater; recovery of wood colonization experiments
	B09-14b_01W	CHE	19.05.09	35°17.916'N	06°38,709'W	354	*Harmothoe evei; Subadyte pellucida*	Crater
Fiúza	TTR14_AT566	Gr	09.08.04	35°15.510'N	06°41.702'W	414	*Pholoides dorsipapillatus; Phyllodoce* (cf.) *madeirensis*	Crater; mud breccia, and marl
Gemini	64PE253_08	NB	07.10.06	35°16.75'N	06°45.72'W	444	*Pholoides dorsipapillatus; Phyllodoce* cf. *madeirensis*	Crater rim
	64PE253_09	NB	07.10.06	35°16.76'N	06°45.76'W	451	*Pholoides dorsipapillatus*	Crater rim
	64PE253_10	NB	07.10.06	35°16.83'N	06°45.54'W	432	*Pholoides dorsipapillatus; Glycera lapidum; Phyllodoce madeirensis*	Crater rim
	64PE253_11	NB	07.10.06	35°16.79'N	06°45.59'W	438	*Glycera lapidum; Phyllodoce* cf. *madeirensis*	Crater rim
	64PE253_13	NB	08.10.06	35°16.65'N	06°46.11'W	516	cf. *Robertianella* sp.; *Glycera lapidum*	Flank
	64PE253_15	NB	08.10.06	35°16.54'N	06°46.47'W	600	*Glycera lapidum*	Flank
	64PE253_17	NB	08.10.06	35°16.29'N	06°46.93'W	612	*Glycera lapidum*	Off mound
	64PE253_18	NB	08.10.06	35°16.39'N	06°46.40'W	608	*Glycera lapidum; Phyllodoce madeirensis*	Off mound
	64PE268_19	NB	05.05.07	35°16.92'N	06°45.47'W	430	*Pholoides dorsipapillatus; Glycera lapidum; Phyllodoce* cf. *lineata*	Crater rim
Kidd	TTR14_AT528	Gr	03.08.04	35°25.304'N	06°43.972'W	489	*Pholoides dorsipapillatus; Glycera* cf. *lapidum; Ophiogoniada* sp.	Crater; mud breccia
	TTR14_AT559	UB	08.08.04	35°24.777'N	06°43.782'W	552	*Phyllodoce madeirensis*	Off MV; hemipelagic sediments
	TTR14_AT560	UB	08.08.04	35°25.306'N	06°43.976'W	498	*Pholoides dorsipapillatus*	Crater; mud breccia
	TTR14_AT561	UB	08.08.04	35°25.602'N	06°44.099'W	526	*Pholoides dorsipapillatus; Phyllodoce* cf. *madeirensis*	Flank; hemipelagic sediments
Anastasia Area	64PE284_12705	NB	21.02.08	36°27.60'N	07°12.33'W	525	*Phyllodoce* cf. *lineata*	
	64PE284_12706	NB	21.02.08	36°26.81'N	07°12.70'W	702	*Glycera lapidum; Phyllodoce* cf. *lineata; Phyllodoce madeirensis*	
Lazarillo	64PE237_20	NB	30.05.05	35°18.99'N	06°47.65'W	516	*Glycera lapidum; Phyllodoce madeirensis*	Flank; hemipelagic sediments
	64PE237_21	NB	30.05.05	35°19.08'N	06°46.40'W	498	*Harmothoe* cf. *evei; Pholoides dorsipapillatus; Phyllodoce madeirensis*	Crater, coral frag
	64PE237_22	NB	30.05.05	35°19.11'N	06°46.26'W	518	*Glycera lapidum*	Flank, coral frag

	64PE253_38A	NB	12.10.06	35°19.09'N	06°46.40'W	494	*Glycera lapidum*	Crater
	64PE253_38B	NB	12.10.06	35°19.09'N	06°46.40'W	497	*Pholoides dorsipapillatus; Glycera lapidum; Phyllodoce madeirensis*	Crater
TTR	TTR12_AT413	G	17.07.02	35°22.048'N	06°55.759'W	695	*Pholoides dorsipapillatus*	Flank; mud breccias and coral debris
	TTR12_AT416	Gr	17.07.02	35°21.870'N	06°52.000'W	695	*Harmothoe evei; Subadyte pellucida; Pholoides dorsipapillatus; Glycerella magellanica*	Flank; coral framework
Meknès	TTR14_AT541	Gr	05.08.04	34°59.103'N	07°04.435'W	703	*Fimbriosthenelais zetlandica; Pholoides dorsipapillatus; Glycera lapidum*	
	TTR15_AT586	Gr	28.07.05	34°59.146'N	07°04.380'W	701	*Glycera lapidum*	Crater; mud breccia
	MSM01-3_319	UB	14.05.06	34°59.100'N	07°04.439'W	695	*Glycera lapidum; Phyllodoce madeirensis*	Crater; mud breccia
	MSM01-3_321	UB	14.05.06	34°58.796'N	07°04.394'W	732	*Harmothoe* cf. *evei; Fimbriosthenelais zetlandica; Pholoides dorsipapillatus; Sthenelais* cf. *jeffreysi; Glycera lapidum; Phyllodoce* cf. *madeirensis*	Carbonate mound; shell ash and coral debris
	MSM01-3_335	UB	15.05.06	34°59.035'	07°04.552'	703	*Glycera lapidum; Phyllodoce madeirensis*	Flank; coral debris, mud breccia
	64PE284_12748	NB	01.03.08	35°58.85'N	07°04.39'W	722	*Pholoides dorsipapillatus; Glycera lapidum*	Crater; mud breccias and shell ash (*Neptunea*)
	B09-14b_03W	CHE	20.05.09	34°59.091'N	07°04.424'W	698	*Harmothoe evei; Subadyte pellucida; Fimbriosthenelais zetlandica; Phyllodoce* cf. *madeirensis*	
Yuma	TTR14_AT524	Gr	02.08.04	35°24.973'N	07°05.461'W	960	*Pholoides dorsipapillatus*	Crater;mud breccia
	TTR16_AT604	Gr	29.05.06	35°25.820'N	07°06.330'W	1030	*Pholoides dorsipapillatus*	Flank; mud breccia
	TTR16_AT605	Gr	29.05.06	35°25.046'N	07°05.450'W	975	*Glycera lapidum*	Cratter; mud breccia
Ginsburg	TTR16_AT607	Gr	29.05.06	35°22.677'N	07°04.979'W	983	*Fimbriosthenelais zetlandica; Glycera lapidum; Glycera tesselata*	Shell ash; carbonate slabs, crusts and coral debris
Jesus Baraza	TTR12_AT391	Gr	09.07.02	35°35.439'	07°12.264'	1105	*Fimbriosthenelais zetlandica*	Crater, mud breccias, and carbonate crusts
Darwin	TTR16_AT608	Gr	30.05.06	35°23.531'	07°11.475'	1115	*Subadyte* cf. *pellucida; Fimbriosthenelais zetlandica; Pholoides dorsipapillatus; Glycera lapidum; Glycera tesselata*	Crater; shell ash; slabs and crusts.
	JC10_028-Rock5	ROV	21.05.07	35°23.514'	07°11.525'	1119	*Pholoides dorsipapillatus*	
	TTR17-2_AT664	Gr	26.06.08	35°23.520'N	07°11.485'W	1128	*Fimbriosthenelais zetlandica; Subadyte pellucida; Glycera lapidum; Glycera tesselata*	Shell ash, carbonate crusts
	B09-14b_02W	CHE	19.05.09	35°23.523'N	07°11.513'W	1100	*Pholoe* cf. *pallida*; *Subadyte* cf. *pellucida;*	

							Glycera tesselata	
Chechaouen	TTR16_AT610	Gr	30.05.06	35°28.468’	07°15.477’	1177	*Glycera lapidum*	Crater; mud breccia (clasts, carbonate crusts)
Cap. Arutyunov	TTR12_AT393	Gr	09.07.02	35°39.740'N	07°19.942'W	1327	*Glycera lapidum*	Crater, mud breccia
	TTR12_AT399	Gr	13.07.02	35°39.805’N	07°19.997’W	1339	*Pholoides dorsipapillatus*	Crater rim; mud breccia
	TTR14_AT546	Gr	06.08.04	35°39.692'N	07°20.046'W	1345	*Pholoe* cf. *pallida; Glycera lapidum*	
	MSM01-3_180	UB	27.04.06	35°39.740'	07°19.960'W	1323	*Panthalis oerstedi; Pholoe* cf. *pallida; Harmothoe* cf. *evei*; *Pholoides dorsipapillatus; Glycera lapidum*	
	MSM01-3_190.1	MC	28.04.06	35°39.665'	07°19.970'W	1322	*Pholoe* cf. *pallida*	
	MSM01-3_195	Gr	28.04.06	35°39.274’	07°20.013’W	1390	*Eulalia* sp.	Flank; coral thicket
	MSM01-3_212	BL	30.04.06	35°39.681'	07°19.981'W	1317	*Glycera lapidum*	
	MSM01-3_218	UB	30.04.06	35°39.700'N	07°20.010'W	1318	*Pholoe* cf. *pallida; Glycera lapidum*	
	MSM01-3_225	BL	04.05.06	35°39.700’N	07°20.010’W	1320	*Pholoe* cf. *pallida; Glycera lapidum; Glycera tesselata*	Crater center; mud breccia
	MSM01-3_274	BL	10.05.06	35°39.706’N	07°20.001’W	1321	*Pholoe* cf. *pallida; Glycera lapidum; Glycera tesselata*	Crater center; mud breccia
	MSM01-3_344	FL	16.05.06	35°39.697’N	07°20.038’W	1320	*Glycera lapidum*	Crater; mud breccia
Sagres	TTR17-2_AT667	Gr	27.06.08	36°02.199'N	08°05.545'W	1562	*Glycera lapidum; Glycera tesselata*	Mud breccia
Carlos Ribeiro	TTR16_AT618	K	31.05.06	35°47.246'N	08°25.303'W	2200	cf. *Eulalia* sp.	
	MSM01-3_157	UB	23.04.06	35°47.270’N	08°25.360’W	2200	*Glycera lapidum*	Crater; mud breccia
	MSM01-3_184	FL	27.04.06	35°47.260'N	08°25.346'W	2200	*Pholoe* cf. *pallida; Pholoides dorsipapillatus; Glycera lapidum*	
	JC10_054		27.05.07	35°47.300'N	08°25.219'W	2179	*Glycera lapidum*	
Unnamed M	TTR17-2_AT673	Gr	28.06.08	35°30.520'N	08°27.660'W	2368	*Glycera lapidum*	Hemipelagic sediments
Bonjardim	TTR15_AT597	Gr	02.08.05	35°27.563'N	09°00.030'W	3061	*Leanira hystricis*	Mud breccia
	MSM01-3_149		22.04.06	35°27.409'N	08°59.586'W	3089	*Glycera lapidum*	
	TTR17-2_AT678	Gr	30.06.08	35°27.529'N	08°59.827'W	3060	*Eumida* cf. *longicirrata*	Crater, mud breccia
Semenovich	TTR17-2_AT679	Gr	30.06.08	35°13.433'N	09°05.186'W	3265	*Glycera lapidum; Glycera tesselata*	Mud breccia
Porto	TTR16_AT622	Gr	03.06.06	35°33.773’N	09°30.416’W	3902	*Leanira hystricis*	Crater; mud breccia
	MSM01-3_161	MC	24.04.06	35°33.754'N	09°30.499'W	3864	*Leanira hystricis*	Crater; mud breccia
	MSM01-3_167		22.04.06	35°33.771'N	09°30.516'W	3862	*Glycera* cf. *lapidum*	
	TTR17-2_AT683	G	01.07.08	35°33.750'N	09°30.365'W	3890	*Glycera lapidum; Glycera noelae*	Mud breccia
Alboran Sea – Cold Seeps								
Mulhacen	TTR17-1_MS416	Gr	20.06.08	35°24.431'N	04°34.119'W	365	*Harmothoe aspera; Glycera lapidum*	Mud breccia
Dakha	TTR17-1_MS413	Gr	19.06.08	35°25.401'N	04°32.021'W	377	*Glycera lapidum; Phyllodoce madeirensis*	Mud breccia

Crow's Foot PM	TTR17-1_MS423	Gr	21.06.08	35°34.106'N	04°42.615'W	572	*Harmothoe* cf. *evei; Leucia violacea*	Mud breccia
	TTR17-1_MS425	Gr	21.06.08	35°34.124'N	04°42.656'W	570	*Harmothoe* cf. *evei; Glycera lapidum*	Mud breccias
Pockmark	TTR17-1_MS427	Gr	21.06.08	35°35.402'N	04°41.158'W	657	*Glycera lapidum*	Sticky clay with carbonates
Reference St	TTR17-1_MS384	UB	12.06.08	35°59.161'N	04°44.976'W	1022	*Glycera lapidum*	Hemipelagic; reference site
Alboran Sea – Carbonate crusts and Cold-Water Corals								
Mellila CMF	TTR17-1_MS392	UB	15.06.08	35°19.515'N	02°39.555'W	246	*Lepidasthenia* cf. *brunnea; Phyllodoce madeirensis*	Hemipelagic , reference site
	TTR17-1_MS393	UB	15.06.08	35°19.799'N	02°33.067'W	245	*Labioleanira yhleni; Glycera lapidum;* cf. *Progoniada* sp.	*Madreporal Lophelia* framework /rubble
	TTR17-1_MS395	Gr	15.06.08	35°26.415'N	02°31.075'W	300	*Harmothoe* cf. *evei; Subadyte pellucida; Pholoides dorsipapillatus*	*Madreporal Lophelia* framework /rubble
Eastern Mediterranean Sea								
Cretan Sea								
	RED10_05	UB	dd.06.10	35°40.66'N	25°06.00'E	1018	*Pholoides dorsipapillatus; Glycera lapidum*	Hemipelagic
	RED11_04	UB	dd.06.11	35°45.70'N	25°06.00'E	1620	*Pholoides dorsipapillatus; Glycera lapidum*	Hemipelagic
	RED11_05	UB	dd.06.11	35°40.66'N	25°06.00'E	1018	*Pholoides dorsipapillatus; Glycera lapidum*	Hemipelagic
	RED11_08	UB	dd..06.11	36°04.50'N	25°17.00'E	1772	*Pholoides dorsipapillatus; Glycera lapidum*	Hemipelagic
	RED11_09	UB	dd.06.11	36°00.00'N	23°53.60'E	1194	*Pholoides dorsipapillatus; Glycera lapidum*	Hemipelagic
Kithira-Antikithira	RED10_03	UB	dd.06.10	35°30.66'N	23°25.00'E	2976	*Glycera lapidum*	Hemipelagic
	RED10_03-1	UB	dd.06.10	35°17.94'N	23°19.00'E	3314	*Glycera lapidum*	Hemipelagic
	RED11_03	UB	dd.06.11	35°30.66'N	23°25.00'E	2976	*Glycera lapidum*	Hemipelagic
	RED11_03-1	UB	dd.06.11	35°17.94'N	23°19.00'E	3314	*Glycera lapidum*	Hemipelagic
Iarapetra Basin	RED10_02-1	UB	dd.06.10	33°42.97'N	26°20.70'E	2720	*Glycera lapidum*	Hemipelagic
	RED11_02	UB	dd.06.11	33°42.97'N	26°08.24'E	2717	*Glycera lapidum*	Hemipelagic
	RED11_02-1	UB	dd.06.11	33°42.97'N	26°20.70'E	2720	*Glycera lapidum*	Hemipelagic
S Crete	RED11_07	UB	dd.06.11	34°36.10'N	24°08.72'E	3614	*Glycera lapidum*	Hemipelagic